imec 2023

Abstract Book

10th & 11th MAY, 2023 KARACHI PAKISTAN

12th INTERNATIONAL MECHANICAL ENGINEERING CONFERENCE

Theme: Role of Mechanical Engineering in Economic Uplift and Sustainability

Jointly Organized by

The Institution of Engineers Pakistan Karachi Centre

NED University of Engineering & Technology, Karachi

NED International Alumni Network (NEDIAN) Association, Pakistan

In Collaboration With

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

Federation of Engineering Institutions of Islamic Countries (FEIIC)

Mehran University of Engineering and Technology Jamshoro

Balochistan University of Engineering & Technology Khuzdar

Balochistan University of Information Technology Engineering & Management Sciences, Quetta

Dawood University of Engineering & Technology, Karachi

DHA Suffa University Karachi

Hamdard University Karachi

Quaid-e-Awam University of Engineering Science &Technology, Nawabshah

Nazeer Hussain University Karachi

Pakistan Navy Engineering College - NUST Karachi

Shaheed Zulfikar Ali Bhutto Institute of Science & Technology, Karachi

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

Pakistan Society of Plumbing Professionals, Karachi

A BRIEF ABOUT IEP

The Institution of Engineers Pakistan was founded with the blessing of the Father of the Nation, Quaid-e-Azam Muhammad Ali Jinnah, in 1948 with its Headquarter at Dhaka. In 1972 the Headquarter was shifted to Lahore. Presently IEP has 5 Capital & Provincial Local Centres at Islamabad, Karachi, Lahore, Peshawar & Quetta and 5 local centres at other major cities which includes Hyderabad, Sukkur, Multan, Faisalabad & Gujranwala. IEP also has 3 International Centres at Saudi Arabia, Bahrain & USA. Beside various Technical programs organized regularly, every year IEP Karachi Centre and NED University of Engineering & Technology, Karachi in collaboration with almost all PEC Accredited Engineering Institutions of Karachi & Balochistan organizes three International Conferences on Civil, Mechanical & Electrical Engineering. In these conferences International & Local researchers, academicians & distinguish Engineers from Industry actively participate and present their papers / research / achievements.

IEP IS AN ACTIVE MEMBER OF FOLLOWING INTERNATIONAL ORGANIZATIONS

1. World Federation of Engineering Organization (WFEO)
2. Federation of Engineering Institutions of Islamic Countries (FEIIC)
3. Federation of Engineering Institution of South & Central Asia (FEISCA)
4. The Asian Civil Engineering Coordinating Council (ACECC)
5. Common Wealth Engineers Council (CEC)
6. Collaboration Agreements with more than 40 National Engineering Bodies of various countries.

DO YOU KNOW WHY YOU SHOULD BECOME A MEMBER OF IEP?

Simply Because!

- ★ You will be exposed to International Experts, International Audience and International Organizations either ONLINE and /or through INPLACE Seminars/Lectures/Conferences
- ★ You will be able to attend; career counseling workshops, training on job seeking techniques, lectures and seminars on Entrepreneurship, skills and many more related topics.
- ★ You will enjoy online access to thousands of national and international engineering professionals, updates on job opportunities globally, information/Consultation regarding further study abroad
- ★ Discount on International Conferences, Congresses, Exhibitions and Workshop conducted regularly by IEP.
- ★ To fulfill the requirement of Pakistan Engineering Council (PEC) to become professional Engineers (PE), you will be able to attend CPD courses conducted by IEP.
- ★ Women Engineers can actively participate in the activities of IEP through IEP Women Engineers Forum (IEP-WEF)

SPECIAL GROOMING PROGRAMS AT IEP FOR YOUNG ENGINEERS

In order to groom the Young budding Engineers, IEP has launched following programs:

- ★ IEP Future Leaders Forum (IEP-FLF) for Young Engineers to show case their technical talents.
- ★ In order to encourage meritorious young engineering graduates to excel in their respective fields, Award of Gold Medal to First Position holders of all PEC Accredited Engineering Programs / Institutions of Karachi.
- ★ Seminar on Resume writing , cover letter and tips for preparation for job interview
- ★ Career counselling session by the academia and industry.
- ★ Job placement through IEP website where prospective Employee & Employer can find their match.
- ★ Various professional / certified training programs for Young Engineers in collaboration with internationally authorized training institutes which could be useful to develop their careers in their respective fields and to increase their employment opportunities.
- ★ Home Based Employment Initiatives for Women Engineers not actively involved in the profession.

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THREE SIMPLE STEPS TO GET IEP MEMBERSHIP

1. Download the IEP membership form from IEP website www.iepkarachi.org.pk or collect the IEP membership form IEP Karachi Centre.
2. Fill the Form and submit the form with following documents:

(i) Attested Photo Copy of Matric Certificate.
(ii) Attested Photo Copy of Intermediate Certificate
(iii) Attested Photo Copy of Degree Certificate,
(iv) Attested Photo Copy of Pakistan Engineering Council Certificate
(v) Attested Copy of CNIC
(vi) Two Passport size photographs.
(vii) Rs. 500/= by cash or pay order / cross cheque in favor of **The Institution of Engineers Pakistan, Karachi Centre**

3.Submit these documents to **The Institution of Engineers Pakistan, Karachi Centre,** 4th Floor, IEP Building, Opp: Hotel Regent Plaza, Shahrah-e-Faisal, Karachi.
Tel: 32780233, 32781492, WhatsApp: 0311-2277721, E-mails: main@iepkarachi.org.pk, iepkc1948@gmail.com, Web: www.iepkarachi.org.pk

TO KNOW MORE ABOUT IEP, FEEL FREE TO CONTACT

Engr. Sohail Bashir, Chairman, IEP, Karachi Centre (E-mail: chairman@iepkarachi.org.pk) **Engr. M. Farooq Arbi**, Secretary, IEP Karachi Centre (E-mail: secretary@iepkarachi.org.pk)
Mr. Sikandar Mannan, Deputy Director, IEP Karachi Center (Cell # 0321-2723095) **Mr. Sharif Khan**, Assistant Director, IEP Karachi Center (Cell # 0312-2356316) **Mr. Shaikh Saifuddin**, Assistant Director, IEP Karachi Center (Cell # 0300-5784726)

message

Muhammad Baligh-ur-Rehman

Governor Punjab

"I am delighted to felicitate the members of The Institution of Engineers Pakistan Karachi Centre, NED University of Engineering and Technology and NED International Alumni Network (NEDIAN) Association Pakistan who are jointly organizing the 12th International Mechanical Engineering Conference (12th IMEC-2023) scheduled to be held on 10th & 11th May, 2023 at Karachi in collaboration with Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia, Mehran University of Engineering & Technology, Jamshoro, Balochistan University of Engineering & Technology, Khuzdar, Balochistan University of Information Technology, Engineering and Management Sciences, Quetta , Dawood University of Engineering & Technology, Karachi, DHA Suffa University, Karachi, Hamdard University, Karachi, Quaid-e-Awam University of Engineering Sciences, & Technology, Nawabshah, Nazeer Hussain University, Karachi Pakistan Navy Engineering College-NUST, Karachi, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Karachi, ASHRAE-Pakistan Chapter and Pakistan Society of Plumbing Professionals, Karachi.

The Institution, which came into existence in 1948 with the blessings of the Father of Nation, Quaid-e-Azam Muhammad Ali Jinnah has contributed immensely towards the development of skills and knowledge in preparing engineers for our nation building goals. The Alumni of this great Institution have done incredibly well.

I am confident that the 12th International Mechanical Engineering Conference themed as "Role of Mechanical Engineering in Economic Uplift and Sustainability" will have far teaching impact in the field of science and engineering. I strongly believe that every advancement in technology today, will give way to a better future. Being attended by engineers from all the provinces of Pakistan as well as of foreign countries, it will provide an excellent opportunity to the participants to benefit from shared experiences and to find solutions to our current national problems.

I am sure that every participant including Institutions will benefit greatly opportunities it provides. The role played by the Institution of Engineers Pakistan as commendable.
Keep it up!"

message

Haji Ghulam Ali

Governor
Khyber Pakhtunkhaw

"It is a matter of great pleasure to know that The Institution of Engineers Pakistan Karachi Centre, NED University of Engineering & Technology, Karachi and NEDIAN International Alumni Network Association Pakistan are organizing the 12th International Mechanical Engineering Conference (IMEC-2023) on 10th & 11th May, 2023 at Karachi, in collaboration with Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia and various academic Institutions of Pakistan. The Conference themed as "Role of Mechanical Engineering in Economic Uplift and Sustainability"

[IMEC-2023] provides a unique platform to eminent Engineers, Scientists, Researchers, Academicians, and Entrepreneur across the globe to participate and share their research advancements and new technologies.

I sincerely hope that the two days of deliberations, discussion, interaction and proactive exchange of ideas will prove to be fruitful and contribute immensely to our mutual growth. I also congratulate the conference organizers for attracting a wide range of papers from Experts in the fields.

The technical talks and papers which will be presented by eminent scientists, researchers, faculty members and industry personnel hopefully will ignite new ideas inspire young graduates to focus on research and development , it will also pave way to work closely with industries for solutions in the relevant technical areas.

I wish every success for the Institution of Engineers Pakistan, Karachi Centre and NED University of Engineering & Technology"

message

Engr. Syed Murad Ali Shah

Chief Minister Sindh

"I am glad to know that the Institution of Engineers Pakistan Karachi Centre, NED University of Engineering and Technology and NED International Alumni Network (NEDIAN) Association Pakistan are jointly organizing the 12th International Mechanical Engineering Conference (IMEC-2023) scheduled to be held on 10th & 11th May, 2023 in collaboration with many other Institutions.

Ever since its inception, the Institution has been endeavoring to keep pace with the ever expanding knowledge in the field of engineering and its dissemination amongst the engineers fraternity throughout the length and breadth of the Country. Over a period of time, the Institution has been, instrumental in the promotion and advancement of science and practice of engineering and the acquisition and exchange of technical knowledge in the field of engineering.

I am confident that the 12th International Mechanical Engineering Conference themed is "Role of Mechanical Engineering in Economic Uplift and Sustainability" will have far reaching impact in the field of science and engineering. I strongly believe that every advancement in technology today, will give lead to a better tomorrow. Being attended by engineers from all the provinces of Pakistan as well as foreign countries, it will provide an excellent opportunity to the participants to benefit from shared experiences and to find solutions to our current problems.

I wish the Institution of Engineers Pakistan, NED University of Engineering and Technology participants of the Conference all the success."

message

Engr. Prof. Dr. Sarosh H. Lodi

Vice Chancellor,
NED University of Engineering and Technology, Karachi

I feel delighted to extend my warmest greetings to all participants of the 12th International Mechanical Engineering Conference that is going to be held at NED University of Engineering & Technology in collaboration with the Institution of Engineers Pakistan (IEP), Karachi Centre and other partner universities. Events like this surely helps bringing forward some creative and innovative research and also engage different stake holders of academia and research altogether.

Mechanical engineering contributes significantly to the development of various industries worldwide. In recent years, the discipline has witnessed many revolutionary advancements in technology, leading to the creation of new industries and opportunities for economic growth. The conference's theme "Role of Mechanical Engineering in Economic Uplift and Sustainability" focuses on the role of mechanical engineering in promoting economic development and sustainability, which is vital for the current challenges being faced by nations all around the world. Various conference topics are going to make this conference a worthwhile experience where the participants will be presenting their researches from sustainable mechanical engineering, modified mechanical structures, applications of reverse engineering, renewable energy technologies, Innovations in mechanical design, material sciences, and many others.

The conference will definitely bring together distinguished speakers, scholars, researchers, and practitioners from academia, industry, and government sectors to share their innovative ideas and research findings in various areas of mechanical engineering. I am confident that this platform will provide a great opportunity for the participants to network, exchange ideas, and explore new collaborations and partnerships.

I would like to extend my congratulations to the organizing committee members who have worked tirelessly to ensure the success of this conference. I would also like to wish all the participants a fruitful and rewarding conference experience. May the conference's outcomes and discussions lead to new research ideas, innovation, and solutions that will promote economic growth and sustainability.

message

Engr. Farhat Adil

President
The Institution of Engineers, Pakistan

It gives me immense pleasure that the Institution of Engineers Pakistan, Karachi Centre, NED University of Engineering & Technology, Karachi and NED International Alumni Network Association are jointly organizing the 12th International Mechanical Engineering Conference on 10th & 11th May, 2023 at NED University, Karachi in collaboration with Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia and almost all premier Engineering Institutions in Sindh & Baluchistan for which IEP Karachi Centre deserves much appreciation.

The theme of the conference "The Role of Mechanical Engineering in Economic Uplift and Sustainability" is very important keeping in view the prevailing economic crises of the country. It is a matter of great satisfaction that renowned expert engineers within the country and also from abroad shall be presenting their valuable papers during the 12th International Mechanical Engineering Conference in the light of its theme.
This year's conference is much more important as we are on shores of the Fourth Industrial and Technological Revolutions that will fundamentally change how we live, work and interact. This transformation will be unlike anything humanity has ever witnessed in its scale, scope and complexity.

During the first industrial revolution, the exploitation of steam technology and hydraulic power of mechanize production process led to change in the initial mindset of people. Manufacturing assembly line became massive with the invention of electricity during the second industrial revolution. The technical innovations of the third industrial revolution brought tremendous changes in mankind's way of life with the creation of electronics, computers, communication technology, programmable logic controllers, information and robots. The labor-intensive industries that emerged from the first revolution were eliminated by the advent of these innovative breakthroughs, while knowledge-based industries became dominant.

This transformation of the Fourth Industrial Revolution is unprecedented and will impact human beings on an unimaginable scale. Emerging technologies such as 5G, Artificial Intelligence, 3D Printing, Robotics, Cloud Computing, Big Data Analysis, Blockchain, Nanotechnology and Virtual Reality are setting new standards for our future lives and technological activities. New machines including cars are become intelligent, autonomous and self-driving like knowledge centers. Sixth-sense technology permeates the digital world through human access.

The performance of the Institution of Engineers Pakistan Karachi Center is commendable for dissemination of engineering knowledge by holding the National, International Engineering Conferences, Technical Seminars, Workshops and lecturers for the benefit of Engineering profession and development of the Country.

I congratulate the Chairman, all Vice Chairmen, Secretary and Local Council Members of Karachi Center for organizing the 12th International Mechanical Engineering Conference.

message

Engr. Sohail Bashir

Chairman, The Institution of Engineers Pakistan, Karachi Centre
Member Governing Body, Pakistan Engineering Council
Member, Executive Committee - FEIIC, FEISCA & ACECC

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 many years, this year also the 12th International Mechanical Engineering Conference is being jointly hosted by the IEP Karachi Centre, NED University and NEDIAN Association. The theme for this year conference is ""Role of Mechanical Engineering I Economic Uplift and Sustainability"

The conference shall dwell on the latest technological development in the field of Mechanical 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, was not only a challenge but was also an uphill task for which IEP Karachi Centre, NEDUET, NEDIAN-Pakistan and all collaborating Institutions deserves all commendation. The collaborative role of FEIIC, FEISCA,, BUITEMS-Quetta, BUET-Khuzdar, DUET-Karachi, DHA Suffa University-Karachi, MUET-Jamshoro, QUEST-Nawbshah, Hamdard University-Karachi,PNEC-NUST-Karachi,SZABIST-Karachi,ASHRAE-Pakistan Chapter and PSPP-Karachi deserves special commendation.

On behalf of The Institution of Engineers Pakistan, Karachi Centre and the Organizing Committee of IMEC-2023, I would like to express my sincere appreciation for active participation, both from academia and industry.. I have no doubt whatsoever that without the cooperation, support and active participatory role of all the members of Advisory Board, Management Committee and Technical Review Committee, this event would not have been possible for which I record my appreciation for all of them. Special thanks to Mr. Richard H. Rooley, Presidential Member ASHRAE & Engr. Farooq Mehboob, President, ASHRAE & CEO, Mehboob & Company, Karachi for their talk in inaugural session and Engr. Zia Ahmed Abbasi, Head of Inspection, National Refinery Limited, Karachi for his talk in the closing session. Thanks to invited speakers from industry, authors and sponsors for strongly supporting the conference. I also take this opportunity to pay my sincere gratitude to the Chief Guest and Guest of Honor 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. Asim Murtaza Khan, President, NEDIAN association, Engr. Prof. Dr. Muhammad Tufail, Pro Vice-Chancellor & NEDUET & Convener 12th IMEC-2023 Engr. Ayaz Mirza, Vice-President(Mechanical & Allied) and Engr. Farooq Arbi, Secretary, IEP, Karachi Centre for their guidance & help in organizing IMEC-2023.

I would like to take this opportunity to place on record my sincere appreciation to Engr. Prof Dr. Mubashir Ali Siddiqui, Chairman, Department of Mechanical Engineering, NEDUET & Co-Convener IMEC-2023, Engr. Dr. Tariq Jamil, Secretary, IMEC-2023, Engr. Abdul Rahim, Vice-Chairman (Mechanical & Allied), IEP Karachi Centre & Chief Organizer, IMEC-2023,Engr. Aijaz ul Haque, Engr. Ghulam Farooq Maniar, Engr. M. Sajid Abbas for their hard work for IMEC-2023.

Finally, I would like to welcome each one of the participant and hope that they will find IMEC-2023 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.

message

Engr. Asim Murtaza Khan

President
NED International Alumni Network
(NEDIAN) Association Pakistan

"It is a matter of great pride that The Institution of Engineers Pakistan, Karachi Centre, NED University of Engineering & Technology and NED International Alumni Network Association Pakistan are jointly holding 12th International Mechanical Engineering Conference on 10th & 11th May, 2023 at NED University of Engineering & Technology, Karachi in collaboration with National 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 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.

"I am confident the delegates, participants and corporate members attending the conference, will benefit by the presentations to be made by the experts from all over Pakistan and abroad, and 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."

I pray for the success of the 12th International Mechanical Engineering Conference."

message

Engr. Amir Zamir Ahmed Khan

Secretary General,
The Institution of Engineers, Pakistan

The Institution of Engineers Pakistan, Karachi Centre, NED University of Engineering & Technology, Karachi, and NED International Alumni Network Association are jointly organizing the 12th International Mechanical Engineering Conference (12th IMEC-2023) on Wednesday, May 10th, and Thursday, May 11th, 2023, at NED University of Engineering & Technology, Karachi. The event is being held in collaboration with the Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia, Mehran University of Engineering & Technology-Jamshoro, Balochistan University of Engineering & Technology-Khuzdar, Balochistan University of Information Technology, Engineering and Management Sciences-Quetta, Dawood University of Engineering & Technology-Karachi, DHA Suffa University-Karachi, Hamdard University-Karachi, Quaid-e-Awam University of Engineering Sciences & Technology-Nawabshah, Pakistan Navy Engineering College-NUST-Karachi, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology-Karachi, The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)-Pakistan Chapter, and Pakistan Society of Plumbing Professionals-Karachi. It is an excellent opportunity for Mechanical Engineering Professionals and enthusiasts to exchange knowledge and ideas.

The Institution of Engineers Pakistan is a leading organization of qualified engineers in the country that has made significant contributions to its development. The IEP Karachi Local Centre is playing a commendable role in spreading modern skills and technology. With recent advancements in science and technology, there is an enormous amount of energy available for mankind to harness for the welfare of humanity. Pakistan has vast natural resources, and it is the duty of our engineers, especially mechanical engineers, to utilize them by upgrading their engineering skills for self-reliance. This will not only minimize the import of engineering items but also save precious foreign exchange, helping the country overcome the existing economic crises by improving economic growth and sustainability of engineering products for the eradication of disease, ignorance, poverty, and hunger.

I would like to express my utmost appreciation to the organizers for choosing the highly relevant and important theme of the conference, "The Role of Mechanical Engineering in Economic Uplift and Sustainability." As a national member of the World Federation of Engineering Organizations (WFEO), the Institution of Engineers Pakistan has a responsibility to follow the Sustainable Development Goals set up by the United Nations. I am confident that this conference will provide a platform to discuss the practice of mechanical engineering in the light of technological advancements and competitive demands for efficient systems. Mechanical engineering is considered the mother of all other engineering disciplines, and the effective and practical role of mechanical engineers can significantly contribute to strengthening economic sustainability and
innovative technology for the development of our country. I look forward to the valuable insights and outcomes that will emerge from this conference.

I share your confidence that the 12th International Mechanical Engineering Conference, with its diverse participation from engineers all over Pakistan, will provide an exceptional opportunity for all the attendees, particularly young engineers. The conference theme, "The Role of Mechanical Engineering in Economic Uplift and Sustainability," is very relevant and significant, and I am sure that the participants will benefit immensely from each other's experiences and knowledge sharing. The conference will undoubtedly provide a platform for young engineers to learn, grow and connect with their peers and seniors in the field, further developing their skills and advancing their careers.

I extend my warm wishes for the success of the Institution of Engineers Pakistan Karachi Centre and all the participants of the 12th International Mechanical Engineering Conference. May this conference bring fruitful discussions, innovative ideas, and productive outcomes of Conference.

message

Engr. Prof. Dr. Muhammad Tufail

Pro Vice-Chancellor
NED University of Engineering & Technology, Karachi
& Convener 12th IMEC-2023

"It is indeed a matter of pleasure that the 12th International Mechanical Engineering Conference is being organised jointly by IEP, Karachi Chapter and NED University of Engineering and Technology. The purpose of such events is sharing the lates knowledge produced as a result of active research so as benefiting all mechanical and allied engineering community, and the World at large. IEP Karachi Chapter in collaboration with NED University and many other prestigious institutes are arranging this year's IMEC conference in continuation to previous 11 conferences. This year's conference, themed "Role of Mechanical Engineering in Economic Uplift and Sustainability," will certainly be an exciting and informative event, with a diverse range of topics to be presented and discussed. This year's conference topics are of utmost importance in the field of mechanical engineering, and they are critical to the development of sustainable solutions that promote economic growth and prosperity while competing the issues affecting the environmental. The conference provides an excellent opportunity for experts in these fields to share their insights and advance knowledge, and network with their peers.

I would like to express my gratitude to the organizing committee for their hard work and dedication in making this conference possible. I am confident that the presentations and discussions will lead to new collaborations which would help shape the future of mechanical engineering.

Finally, I wish all the participants a fruitful and enjoyable conference experience. May this conference be a catalyst for growth and innovation in the field of mechanical engineering and contribute to economic progress and sustainability in our society."

message

Engr. Ayaz Mirza

Vice-President, (Mechanical and Allied)
The Institution of Engineers Pakistan

I am pleased to welcome you all in 12th International Mechanical Engineering Conference (IMEC-2023) Jointly organized by The Institution of Engineers Pakistan, Karachi Centre, NED University of Engineering and Technology and NED International Alumni Network (NEDIAN) Association Pakistan scheduled to be held on 10th & 11thMay, 2023 in collaboration with International and National Institutions. This conference has a fantastic line up of keynote sessions, webinars sessions by eminent speakers, paper presentation sessions to present the latest outcomes related to advancements in Mechanical Technologies.

In spite of the fact that current global pandemic has created enormous challenges and tremendous impacts on life of each one of us, Mechanical engineers play key roles in a wide range of industries including automotive, aerospace, biotechnology, computers, electronics, microelectronic mechanical systems, energy conversion, robotics and automation, and manufacturing. The evolution of technologies related to climate change as represented by patent data shows that we are yet to witness the intensity of activities associated with a new innovation wave of sustainable technologies. What individual countries are aiming to achieve through innovation will not be enough to deal with the scale of the existing problems. Targeted global efforts are required for the new innovation wave to pick up and a global green system of innovation is needed. I hope this Conference will lead to resolve all the engineering issues and will be able to set new agenda for the overall success of the engineers and the engineering community.
This includes solving today's problems and creating future solutions in health care, energy, transportation, world hunger, space exploration, climate change, and more. This conference will provide you an opportunity to set your vision as well as lay down your plans for your organization as it takes on the challenges and opportunities of our time. May this exercise strengthen the bonds of camaraderie, deepen professional ties, and increase collaboration for the advancement of your field, for our shared aspirations of equitable progress in our nation.

As Vice-President (Mechanical and Allied) I am grateful to all our foreign delegates, participants, learned speakers of 12th Mechanical Engineering Conference (IMEC-2023). Organizer of IMEC 2023, Prof. Dr. Mubashir Ali Siddiqui, Co-Convener, IMEC-2023 Dr. Tariq Jamil, Secretary IMEC- 2023, for their concerted efforts to make this Conference a success.

On behalf of the Central Council, The Institution of Engineers Pakistan, and my own behalf, I congratulate the Organizing Committee for their efforts particularly I would like to thank Engr. Prof. Dr. Sarosh Hashmat Lodi, Vice-Chancellor, NED University of Engineering and Technology for his support for providing the venue of this conference, I also thank Engr. Prof. Dr. Muhammad Tufail, Pro Vice-Chancellor, NED University of Engineering and Technology, Convener of IMEC-2023 for his support and cooperation with the Institution of Engineers Pakistan, Karachi Centre.

I congratulate Engr. Sohail Bashir, Chairman, IEP Karachi Centre and Engr. Farooq Arbi, Secretary, IEP, Karachi Centre, in accepting the challenge in organizing this conference. I also congratulate members of all the committees, specially, Engr. Abdul Rahim, Vice-Chairman (Mechanical & Allied), IEP, Karachi Centre, Engr. M. Aijazul Haque, Engr. Ghulam Farooq Maniar and Engr. Abbas Sajid , Member Central Council, IEP, Karachi Centre

Looking forward to see you in the Conference

message

Engr. Prof. Dr. Syed Amir Iqbal

Dean, Faculty of Mechanical and Manufacturing Engineering
NEDUET, Karachi & Co-Convener IMEC-2023

"It is my immense pleasure to welcome you to the 12th International Mechanical Engineering Conference IMEC'23. This year, we have particularly chosen the topic of the conference. After COVID, a number of countries have gone into serious financial crises. I would like to congratulate all the participants of this conference and thank them all for sharing their valuable insights.

Entrepreneurial businesses and startup are directly linked to innovation and new products which usually come out of engineering profession. Mechanical engineering plays a crucial role in driving economic growth and promoting sustainability. The conference will provide a platform for academics, researchers, industry experts, and policymakers to discuss and deliberate on the latest developments, trends, and challenges in the field of mechanical engineering.

The infrastructure of the county is getting outdated and because of large investments involved in their upgradation, we still need to run technical retired plants/equipment. Besides, working on new ideas, our engineers should be good in modification, re-fittings, and reverse engineering the equipment wherever this may work.

Finally, I'd want to express my gratitude to the members of the IEP and NED committees, volunteers, their efforts in making this event successful. I hope, the conference will provide an opportunity for networking and collaboration to all participants."

message

Engr. Prof. Dr. Mubashir Ali Siddiqui

Chairman, Department of Mechanical Engineering, NEDUET
& Co-Convener, 12th -IMEC-2023

"After having successfully arranged eleven, the 12th International Mechanical Engineering Conference (IMEC) is scheduled on 10th and 11th of May 2023. The Conference Theme has been particularly selected as "Role of Mechanical Engineering in Economic Uplift and Sustainability" keeping in view the need of the State.

The Country is in dire need of an increase in exports and reduction in imports, thereby requiring the need for in-house development and localization, implementing energy efficient practices, adopting current advances, and reducing burden on imported fuel. An important feature of this event is a significant number of industrial dignitaries who would be sharing their views with a larger audience.

I hope that academia and industry will equally get benefitted from this valuable conference, and pray for the success of the same."

message

Engr. M. Farooq Arbi

Secretary
Institution of Engineers Pakistan, Karachi Centre

I am glad that The Institution of Engineers Pakistan Karachi Centre, NED University of Engineering & Technology, and NED International Alumni Network Association- Pakistan are jointly organizing 12th International Mechanical Engineering Conference 12th-IMEC-2023) schedule to be held on 10th & 11th May, 2023 at Karachi in collaboration with Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia, Mehran University of Engineering & Technology, Jamshoro, Balochistan University of Engineering & Technology, Khuzdar, Balochistan University of Information Technology, Engineering and Management Sciences, Quetta, Dawood University of Engineering & Technology, Karachi, DHA Suffa University, Karachi, Hamdard University, Karachi, Quaid-e-Awam University of Engineering Sciences, & Technology, Nawabshah, Nazeer Hussain University, Karachi Pakistan Navy Engineering College-NUST, Karachi, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Karachi, ASHRAE-Pakistan Chapter and Pakistan Society of Plumbing Professionals, Karachi

On behalf of The Institution of Engineers Pakistan, Karachi Centre and the Organizing Committee of 12th-IMEC-2023, I would like to express my sincere appreciation to all partner organizations, all the members of Advisory Board, Management Committee, Coordination Committee and Technical Review Committee who worked extremely hard for this event, Special thanks to the Conference Key Note Speakers of Inaugural and Closing Sessions, invited speakers from industry, authors and sponsors for strongly supporting the 12th-IMEC-2023. I also take this opportunity to pay my sincere gratitude to the Chief Guest and Guest of Honors 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. Muhammad Tufail, Pro-Vice-Chancellor, NEDUET & Convener IMEC-2023 Engr. Prof. Dr. Mubashir Ali Siddiqui, Chairman, Department of Mechanical Engineering, NEDUET, Engr. Abdul Rahim, Vice-Chairman (Mechanical & Allied) , IEP, Karachi Centre and Chief Organizer, 12th International Mechanical Engineering Conference and Dr. Tariq Jamil, Secretary, IMEC-2023

I am confident that the 12th International Mechanical Engineering Conference themed as "The Role of Mechanical Engineering in Economic Uplift and Sustainability" will have far reaching impact in the field of science and engineering. I strongly believe that every advancement in technology today, will give way to a better successor. Being attended by engineers from all provinces of Pakistan as well as foreign countries, it will provide an excellent opportunity to the participants to benefit from shared experiences and to find solutions to our current national problems.

The Organizing Committee deserves great appreciation for their un-tiring efforts and I convey my warm greetings and felicitations to them and the participants and extend my best wishes for the success of this conference.

message

Engr. Abdul Rahim

Vice-Chairman (Mechanical & Allied), IEP Karachi Centre
& Chief Organizer, IMEC-2023

"I feel honored to welcome all the 12th International Mechanical Engineering Conference IMEC-2023 jointly organized The Institution of Engineers Pakistan (IEP), NED University of Engineering & Technology, Karachi and NED Intentional Alumni Network Association- Pakistan in collaboration with Federation of Engineering Institutions of Islamic Countries, Federation of Engineering Institutions of South & Central Asia on 10th & 11th May, 2023. This year theme is "Role of Mechanical Engineering in Economic Uplift and Sustainability"

The conference shall focus on Revers Engineering using Latest Technology in the field of Mechanical Engineering which is need of current situation. Conference shall disseminate knowledge and broaden the vision of the participants that led young engineers to explore new ways of entrepreneurship.

As Vice-Chairman (Mechanical) of the Institution of Engineers Pakistan Karachi Centre and member of the 12th IMEC-2023 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 the keynote speakers and authors.

I wish all the authors, presenters and delegates a successful gathering."

message

Engr. Muhammad Abbas Sajid

General Secretary
Pakistan Society of Plumbing Professionals

"I am delighted to have the opportunity to share a few thoughts at the time of 12th International Mechanical Engineering Conference (12th IMEC-2023). It is a great initiative taken by Institution of Engineers Pakistan (IEP) Karachi Centre, NED University of Engineering and Technology Karachi, NED International Alumni Network (NEDIAN) Association Pakistan, ASHRAE Pakistan Chapter and Pakistan Society of Plumbing Professionals at NEDUET, Karachi in collaboration with National International Institutions. The 12th edition of the conference itself is an indicator of the quality and credibility of the Conference Internationally.

The theme of the conference modern times as technological advancements have made "Role of Mechanical Engineering in Economic Uplift and Sustainability" is very relevant in a huge impact on Mechanical Engineering globally. The tracks included in the conference reflect the sustainability occurring in the field of Mechanical Engineering,

IEP and NED University deserves a great applause for bringing academia, industry experts, and other stakeholders from all over the world to address common challenges. I congratulate all office bearers, and organizers of the conference for organizing such a wonderful event and I wish them great success."

message

Engr. Dr. Tariq Jamil

Secretary IMEC'23 Conference
Assistant Professor, Department of Mechanical Engineering.
Joint Secretary, Advanced Studies Research Board,
NED University of Engineering and Technology, Karachi.

"It is my honor to be the secretary of the 12th International Mechanical Engineering Conference (IMEC'12). The theme of the conference - "Role of Mechanical Engineering in Economic Uplift and Sustainability "was carefully chosen due to the present economic crises in Pakistan and in many other countries. The conference encompassed a wide range of topics in the field of Mechanical Engineering, including advances in sustainable mechanical engineering, retrofitting and modification of mechanical structures and systems, localization, entrepreneurial, and commercialization case studies, reverse engineering practices and case studies, renewable and alternate energies, additive manufacturing prospects in third world countries, emerging areas of mechanical and aerospace, innovations in mechanical design and manufacturing, and material science and nanotechnology from an economic perspective.

The purpose of this conference is to bring researchers from academia and professionals from industry on one table to discuss the potential areas of collaboration for economic revival. After COVID 19 followed up by damage to the infrastructure because of recent flooding, the country needs very serious efforts for opening new business horizons and reducing reliance on imports. This could not be possible without the involvement of engineers, their innovative ideas and hard work.

I would like to thank for the active participation from universities across Pakistan. The papers and presentations that we have received so far covered a diverse range of topics. I hope it will provide new insights into the latest advancements and research in the field of mechanical engineering. The proceedings of the conference with full length papers will be shorlty available on the conference website.

I would like to welcome all the keynote and invited speakers from industry, paper presenters and participants for their interest and contributions to the conference. With their support, I may be able to uplift the quality of the conference."

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The Institution of Engineers Pakistan

INAUGURAL SESSION
Wednesday the 10th May, 2023
at Main Auditorium, NEDUET, Karachi

2:00 pm	**Guests Arrival**
2:15 pm	**Guests to be seated**
2:30 pm	**Recitation from the Holy Quran**
2:35 pm	**National Anthem**
2:40 pm	**Conference Briefing by** Engr. Prof. Dr. Syed Amir Iqbal Dean, Mechanical and Manufacturing Engineering, NEDUET, Karachi & Co-Convener, 12th IMEC-2023
2:45 pm	**Address by** Engr. Prof. Dr. Muhammad Tufail Pro-Vice Chancellor, NEDUET, Karachi & Convener, 12th IMEC-2023
2:55 pm	**Welcome Address by** Engr. Sohail Bashir Chairman, IEP Karachi Centre
3:05 pm	**Technical Presentation by** Mr. Richard H. Rooley Presidential Member, ASHRAE
3:25 pm	**Keynote Address by** Engr. Farooq Mehboob President, ASHRAE & CEO, S. Mehboob & Company, Karachi
3:45 pm	**Address by** Engr. Farhat Adil President, Institution of Engineers Pakistan
3:55 pm	**Address by Guest of Honor** Engr. Asim Murtaza Khan President, NED International Alumni Network Association Pakistan
4:05 pm	**Address by** Engr. Prof. Dr. Sarosh Hashmat Lodi Vice-Chancellor, NEDUET, Karachi
4:20 pm	**Address by Chief Guest**
4:35 pm	**Presentation of Conference Mementos**
4:45 pm	**Vote of Thanks by** Engr. Ayaz Mirza Vice-President (Mechanical & Allied), IEP
4:55 pm	**Refreshments**
5:30 pm	**Asr Prayer**

The Institution of Engineers Pakistan

CLOSING SESSION
Thursday the 11th May, 2023
at Mechanical AV Conference Hall, NEDUET, Karachi

3:40 pm	**Recitation from the Holy Quran**
3:45 pm	**Conference Highlights by** Engr. Prof. Dr. Mubashir Ali Siddiqui Chairman, Department of Mechanical Engineering, NEDUET, Karachi & Co-Convener, IMEC-2023
3:50 pm	**Address by** Engr. Sohail Bashir Chairman, IEP, Karachi Centre
4:00 pm	**Address by** Engr. Prof. Dr. Muhammad Tufail Pro-Vice Chancellor, NEDUET, Karachi & Convenor, 12th IMEC-2023
4:05 pm	**Keynote Address by** Engr. Zia Ahmed Abbasi Head Inspection at National Refinery Limited
4:25 pm	**Address by** Engr. Farhat Adil President, Institution of Engineers Pakistan
4:35 pm	**Address by Guest of Honor** Engr. Muhammad Abbas Sajid Chair of Honors and Awards Committee of ASHRAE Region at Large & Secretary General, Pakistan Society of Plumbing Professionals, Karachi
4:45 pm	**Address by** Engr. Dr. Sarosh Hashmat Lodi Vice-Chancellor, NEDUET, Karachi
4:55 pm	**Address by Chief Guest**
5:05 pm	**Chairman's Medal for Best Paper & IEP Award for Best Poster**
5:15 pm	**Conference Recommendations** Engr. Dr. Tariq Jamil Assistant Professor, Department of Mechanical Engineering, NEDUET, Karachi & Secretary, IMEC-2023
5:20 pm	**Vote of Thanks** Engr. M. Farooq Arbi Secretary, IEP, Karachi Centre
5:35 pm	**Refreshments / Asr Prayer**

imec 2023

Technical Sessions
Thursday, May 11, 2023

at Mechanical AV Conference Hall

Technical Session 1-A

on **"Advances in Sustainable Mechanical Engineering", "Innovations in Mechanical Design and Manufacturing"**
Time: 9:30 am - 11:10 am

Session Chairs
Engr. Prof. Dr. Murtuza Medhi, Professor, Department of Mechanical Engineering, NED UET
Engr. Dr. Mumtaz Hussain Qureshi, Assistant Professor, Department of Mechanical Engineering, NED UET
Engr. Ghulam Farooq Maniar
Member Central Council, IEP, Karachi Centre
Invited Talk from Industry
Engr. Azeem Anwar, CEO, SignAxes (Pvt.) Ltd

Tea Break (11:10 am to 11:30 am)

Technical Session 2-A

on **"Renewable and Alternate Energies"**
Time: 11:30 am - 1:10 pm

Session Chairs
Engr. Dr.-Ing Usman Allauddin, Associate Professor, Department of Mechanical Engineering, NED UET
Engr. Dr. Syed Ahmad Raza, Assistant Professor, Department of Mechanical Engineering, NED UET
Engr. Abdul Wahab Tajwani
Member Local Council, IEP, Karachi Centre
Invited Talk from Industry
Engr. Abdul Rahim, Vice Chairman IEP Karachi Center, Principal Engineer, Modtech Services

Lunch & Prayer Break (1:10 pm to 2:00 pm)

Technical Session 3-A

on **"Material Science and Nanotechnology from Economic Perspective"**
Time: 2:00 pm - 3:40 pm

Session Chairs
Engr. Dr. Muhammad Shakaib, Professor, Department of Mechanical Engineering, NED UET
Engr. Dr. Muhammad Muzamil, Assistant Professor, Department of Mechanical Engineering, NED UET
Engr. Dr. Syed Ali Hasnain Naqvi
Member Local Council, IEP, Karachi Centre
Invited Talk from Industry
Engr. Basit Iqbal Khan, Unit Manager Projects, Fauji Fertilizer Power Company Limited

at Civil AV Conference Hall

Technical Session 1-B

on **"Emerging Areas of Mechanical and Aerospace", "Additive Manufacturing Prospects in Third World Countries"**
Time: 9:30 am - 11:10 am

Session Chairs
Engr. Dr. Muhammad Uzair, Associate Professor, Department of Mechanical Engineering, NED UET
Engr. Dr. Kashif Noor, Assistant Professor, Department of Mechanical Engineering, NED UET
Engr. Aijaz ul Haque
Member Central Council, IEP, Karachi Centre
Invited Talk from Industry
Engr. Dr. Bilal Siddiqui, COO, Woot Tech.

Technical Session 2-B

on **"Localization, Entrepreneurial, and Commercialization Case Studies"**
Time: 11:30 am - 1:10 pm

Session Chairs
Engr. Dr. Haider Ali, Associate Professor, Department of Mechanical Engineering, NED UET
Engr. Dr. M. Ehtesham ul Haque, Assistant Professor, Department of Mechanical Engineering, NED UET
Engr. Mustafa Hussain
Member Local Council, IEP, Karachi Centre
Invited Talk from Industry
Engr. Muhammad Abbas Sajid, Chair of Honors and Awards Committee of ASHRAE Region at Large & Secretary General, Pakistan Society of Plumbing Professionals, Karachi

Technical Session 3-B

on **"Retrofitting and Modification of Mechanical Structures and Systems", "Reverse Engineering Practices and Case studies"**
Time: 2:00 pm - 3:40 pm

Session Chairs
Engr. Dr. Muhammad Wasif, Associate Professor, Department Of Industrial and Manufacturing Engineering, NED UET.
Engr. Dr. Muhammad Uzair Yousuf, Assistant Professor, Department of Mechanical Engineering, NEDUET
Engr. Ifrah Asif
Member Local Council, IEP, Karachi Centre
Invited Talk from Industry
Engr. Majid Hasan, CEO at NKR Engineering (Pvt) Ltd.

Parallel Poster Session of Final Year Undergrad Projects
Thursday, May 11th 2023 (9:30 am – 3:40 pm)
at Room 60 and Extension 1 Next to Mechanical AV Hall

CLOSING SESSION Thursday the 11th May, 2023 (3:40 pm) at Mechanical AV Conference Hall, NEDUET, Karachi

PROGRAMME

TECHNICAL SESSIONS (THURSDAY,May 11, 2023)-

Technical Session 1-A

Mechanical AV Conference Hall

"Advances in Sustainable Mechanical Engineering", "Innovations in Mechanical Design and Manufacturing"

Time: 9:30 am - 11:10 am

Paper 01 (9:30 am – 9:50 am)	Paper 02 (9:50 am – 10:10 am)	Paper 03 (10:10 am - 10:30 am)	Paper 04 (10:30 am – 10:50 am)	Invited Talk (10:50 am – 11:10 am)
Numerical Investigation of a Novel Design of Cross Axis Wind Turbine with Improved Efficiency by **Faheem abbas**, Usama Ali, Adnan Rasheed, Mumtaz a. Qaisrani, M. Basit Shafiq, Usman Allauddin, Muhammad Umar Farooq, Shajar Abbas, Ali Zulkarnain	Design Optimization and Performance Assessment of a Novel Savonius Wind Turbine by **Saqlain Saeed**, Saqlain Ali, Khizar Hayat, Muhammad Zahid, Mumtaz A. Qaisrani, M. Basit Shafiq, Muhammad Umer Farooq, Usman Allauddin	Desulfurization Of Diesel Oil for the Upgradation to Euro V Emission Standard by **Muhammad Ali,** Muzaffar Ali, M Shahrukh Atta, Usama Asghar, Sadeed Ullah Khan Jano, Haris Khan M. Iftikhar ul Hassan	Solar Powered Stirling Engine for Domestic Household and Rural Areas in Karachi, Pakistan by Muhammad Uzair, **Masood Ahmed Khan**, Osama Anis Azan Ahmed	"Application of Machine Vision Technology for the betterment of Local Industry" by **Engr. Azeem Anwar**, CEO, SignAxes (Pvt.) Ltd.

Technical Session 1-B

Civil AV Conference Hall

on "Emerging Areas of Mechanical and Aerospace", "Additive Manufacturing Prospects in Third World Countries"

Time: 9:30 am - 11:10 am

Paper 01 (9:30 am – 9:50 am)	Paper 02 (9:50 am – 10:10 am)	Paper 03 (10:10 am - 10:30 am)	Paper 04 (10:30 am – 10:50 am)	Invited Talk (10:50 am – 11:10 am)
Performance and Emissions Analysis of a Diesel Engine Fueled by Diesel Mixtures with Manganese Oxide and Carbon Nanotubes Fuel Additives by Muhammad Sarfraz Ali, Sadia Saleem, **Rozeena Aslam**, Hamza Akhtar, Muhammad Imran, Talha Nadeem Hassan, Abdul Rehman, Muhammad Faheem Nazar, and Anees ur Rehman	Modeling of Surface Roughness and Optimization of Cutting Parameters for Milling Of 42CrMo4 by Coated Carbide Tool Inserts by **Hamza Khalid**, Mirza Jahanzaib, Muhammad Jawad, Uroosa Malik	Simulation-Based Modal Analysis of Cracked Cantilever Beam by **Ahmad Naveed**, Muhammad Usman, Muhammad Bu Ali, Muhammad Haseeb, Zain Abbas Tahir, Ali Husnain Ahmad Tabassum, Haseeb Arshad	Design, Fabrication, and Study of Reinforced Arc Weld Joints by **M. Saad Suleman** Masood Ahmed Khan Murtaza Mehdi Shahzaib Nazim	Unmanned Aerial Vehicles - R&D and Manufacturing Challenges in Pakistan by **Engr. Dr. Bilal Siddiqui,** COO, Woot Tech.

TEA BREAK

Technical Session 2-A Mechanical AV Conference Hall on **"Renewable and Alternate Energies"** Time: 11:30 am - 1:10 pm				
Paper 01 (11:30 am – 11:50 am)	Paper 02 (11:50 am – 12:10 pm)	Paper 03 (12:10 pm - 12:30 pm)	Paper 04 (12:30 pm – 12:50 pm)	Invited Talk (12:50 pm – 1:10 pm)
A Novel Study on Performance Evaluation of Single Flow Double Pass Solar Air Heater with Phase Change Materials by **Zeeshan Rasool,** Muhammad Imran Akram, Rabeet Yousaf, Muhammad Sarfraz Ali, Sadia Saleem	Numerical Investigation of Small-Scale Wind Turbine for Commercial Buildings by **Osama Qadeer**, M. Usman Khan, M. Basit Shafiq, Usman Allauddin, Mumtaz A. Qaisrani, Liaquat Ali Khan	Effect of Flow Rate on Various Parameters of Archimedes Screw Water Turbine Using Experimental and CFD Analysis by **Muhammad Ahsan,** Pervaiz Khan	Phosphoric Acid Fuel Cell Based CCHP System for a Sustainable Commercial Farm and Crop Research Facility by Muhammad Maaz, **Aleena Amin Khuwaja**, Jaishree Rajput, Muhammad Arsal, Aleena amin Huwaja	Applications of Reverse Engineering and use of CAD/CAM in Renewable Technologies By **Engr. Abdul Rahim**, Vice Chairman IEP Karachi Center, Principal Engineer, ModTech Services
Technical Session 2-B Civil AV Conference Hall **on "Localization, Entrepreneurial, and Commercialization Case Studies"** Time: 11:30 am - 1:10 pm				
Paper 01 (11:30 am – 11:50 am)	Paper 02 (11:50 am – 12:10 pm)	Paper 03 (12:10 pm - 12:30 pm)	Paper 04 (12:30 pm – 12:50 pm)	Invited Talk (12:50 pm – 1:10 pm)
Environmental and Financial Feasibility of a Solar-Powered Air-Conditioning System for a Passenger Train in Pakistan by **Haris Riaz**, Muhammad Asim Ghaffar, Salman Aziz, Ahmad Bilal	Investigation of Fluid Elastic Instability Effect on Grooved Tube Heat Exchanger Using In-Line Square Arrangement by **Hassan Shawar Shah** Muzaffar Ali, Muhammad Ammar Akram, Asif Durez, Fawad Yousaf Malik	Comparative Study for Selection of Suppliers Using MCDM Tools by **S. Ali Imran Zaidi**, Zaheer Ahmed, S. Jawad Hussain Zaidi., S. Adil Abbas Zaidi	Development and Performance Study of Lab Scale Continuously Stirred Tank Reactor for Biogas Production by **Asad A. Zaidi**, Abdul Hameed Memon, Rahool Rai, Muhammad Uzair	Entrepreneurship - Horizons for Mechanical Engineers by **Engr. Muhammad Abbas Sajid**, Chair of Honors and Awards Committee of ASHRAE Region at Large & Secretary General, Pakistan Society of Plumbing Professionals, Karachi
LUNCH & PRAYER BREAK				

Technical Session 3-A

Mechanical AV Conference Hall

on **"Material Science and Nanotechnology from Economic Perspective"**

Time: 2:00 pm - 3:20 pm

Paper 01 (2:00 pm – 2:20 pm)	Paper 02 (2:20 pm – 2:40 pm)	Paper 03 (2:40 pm – 3:00 pm)	Invited Talk (3:00 pm – 3:20 pm)	Invited Talk (3:20 pm – 3:40 pm)
Thermal Analysis of Shell and Tube Heat Exchanger and its Optimization Using Different Materials by **Usama Asghar**, Abdullah Rafique, Muhammad Talha Aziz, Danyal Iqbal, Aymen Nadeem	Stretching Analysis of Copper Thin Film with BS-8599 v7 RTV Substrate Using Computer Simulations by **Shahzaib Nazim**, Murtuza Mehdi, Saad Suleman	Performance Evaluation of Multi-Nozzle Pesticide Sprayer with Chain & Sprocket Mechanism by **Rahool Rai**, Asad Ali Zaidi, Kashif Ahmed, Muhammad Uzair, Ali Mustafa Shah	Material Science in Fitness for Service Assessment of Ageing Engineering Component by **Engr. Dr. Muhammad Kashif**, Assistant Professsor, Center for Manufacturing and Materials, Coventry University, UK	Improving the Boiler Life Through the Application of Thermal Spray Coating by **Engr. Basit Iqbal Khan**, Unit Manager Projects, Fauji Fertilizer Power Company Limited

Technical Session 3-B

Civil AV Conference Hall

on **"Retrofitting and Modification of Mechanical Structures and Systems", "Reverse Engineering Practices and Case studies"**

Time: 2:00 pm - 3:20 pm

Paper 01 (2:00 pm – 2:20 pm)	Paper 02 (2:20 pm – 2:40 pm)	Paper 03 (2:40 pm – 3:00 pm)	Paper 04 (3:00 pm – 3:20 pm)	Invited Talk (3:20 pm – 3:40 pm)
Performance And Emission Analysis of a Diesel Engine Using Diesel Mixtures with Biodiesel and Carbon Nanotubes by **Muhammad Sarfraz Ali,** Sadia Saleem, Rozeena Aslam, Hamza Akhtar, Muhammad Imran, Talha Nadeem Hassan, Abdul Rehman	Optimization And Performance Analysis of Natural Gas-Based Combined Cycle Power Plant Using Post Combustion Process by **Abdul Rehman**, Abid Hussain, Muhammad Mubashir Iqbal, Haris Khan, Ahmed Usman	Reduction Of Rework Rates in Manufacturing of Domestic Gas Meters Through the Implementation of DMAIC Methodology by Ifrah Asif, **Eylia Jaffery**, Syed Muhammad Abbas, Muhammad Ali Arshad, Hammad Ahmed Memon, Syed Shabbir Rehman	Design and Development of Compact Equipment for the Grading of Material Composed of Dry Micro Size Particles By Tariq Jamil, Ghufran Ullah, **M. Saad Jamali**, M. Ahmed, Sheikh Fahad Ahmed	Reverse Engineering Practices and Case Studies by **Engr. Majid Hasan**, MD at NKR Engineering (pvt) Ltd.

Closing Ceremony at Mechanical AV Conference Hall

Day & Date: Thursday 11th May, 2023, Time: 9:30 am - 11:10 am
Technical Session 1-A
Mechanical AV Conference Hall
"Advances in Sustainable Mechanical Engineering"
"Innovations in Mechanical Design and Manufacturing"

Technical Session 1-A | **ADVANCES IN SUSTAINABLE MECHANICAL ENGINEERING**

NUMERICAL INVESTIGATION OF A NOVEL DESIGN OF CROSS AXIS WIND TURBINE WITH IMPROVED EFFICIENCY

Faheem Abbas[1], Usama Ali[1], Adnan Rasheed[1], Mumtaz A. Qaisrani[1*] M. Basit Shafiq[2], Usman Allauddin[3], Muhammad Umar Farooq[1], Shajar Abbas[1], Ali Zulkarnain[1]
[1]Institute of Mechanical and Manufacturing Engineering, Khwaja Fareed University of Engineering and Information Technology, Rahim Yar Khan, Pakistan.
[2]Department of Mechanical Engineering, National University of Technology, Islamabad, Pakistan
[3]Department of Mechanical Engineering, NED University of Engineering and Technology, Karachi
***Corresponding Author E-mail Address: mumtazahmed@kfueit.edu.pk**

Wind energy is viewed as a growing renewable energy source, as opposed to fossil fuels, which are finite and create harmful emissions. Modern wind turbines, such as horizontal axis wind turbines (HAWTs) and vertical axis wind turbines (VAWTs), have significant drawbacks that reduce their effectiveness. In order to maximize wind energy output, a cross axis wind turbine (CAWT) has been developed to overcome the aforementioned problems. CAWT has a unique design that combines the horizontal and vertical blades arranged in a cross-axis pattern. In this paper, Computational Fluid Dynamics (CFD) is used to analyze the aerodynamic performance of various airfoil shapes for CAWT. The study aims to identify the airfoil with the maximum lift coefficient, which is essential for maximizing the wind turbine's output. Findings indicated that, among the evaluated airfoils, FX 63-137 had highest lift coefficient. By employing this airfoil shape to horizontal blades of CAWT might potentially maximize energy output. **Keywords:** Cross axis wind turbine, CFD, NACA FX63-137.

Technical Session 1-A | **ADVANCES IN SUSTAINABLE MECHANICAL ENGINEERING**

DESIGN OPTIMIZATION AND PERFORMANCE ASSESSMENT OF A NOVEL SAVONIUS WIND TURBINE

Saqlain Saeed[1], Saqlain Ali[1], Khizar Hayat[1] , Muhammad Zahid[1] , Mumtaz A. Qaisrani[1*], M. Basit Shafiq[2], Muhammad Umer Farooq[1], Usman Allauddin[3]
[1]Institute of Mechanical and Manufacturing Engineering, Khwaja Fareed University of Engineering & Technology, Rahim Yar Khan, Pakistan
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In this study, the performance of a novel blade design of a Savonius wind turbine is computationally analyzed. The Shear Stress Transport (SST) k- turbulence model is used with ANSYS-Fluent to propose and analyze a 3-dimensional rotor blade model. The redesigned turbine design is contrasted with the industrystandard reference design, and the coefficient of power (CP) is assessed against spin at various tip speed ratios (TSR). The optimum value for TSR was fund to be 0.7 and at this value the proposed design surpasses the reference design. The novel turbine design optimized torque is 0.15 N-m, which is 17.2% more torque than the conventional design. The findings imply that the novel Savonius wind turbine design can provide better performance than conventional designs.
Keywords: Novel Wind Turbine, Cfd Wind Blade, Savonius Wind Turbine

Technical Session 1-A | **ADVANCES IN SUSTAINABLE MECHANICAL ENGINEERING**

DESULFURIZATION OF DIESEL OIL FOR THE UPGRADATION TO EURO V EMISSION STANDARD

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The current research work investigates the usage of task specified ionic liquids (ILs) for the removal of dibenzothiophene (DBT) from diesel oil and upgrading the fuel to meet the euro V emission standard having 10 ppm sulfur content. Model oil for current research was produced by adding DBT in n-dodecane separately. A number of experimental variables were taken into account while determining the desulfurization efficiency such as temperature, time, volume ratio of IL to model oil, and amount of H2O2. DBT was effectively extracted from the model oil using an ionic liquid based on pyridinium n-hexylpyridinium tetrafluoroborate [C6Py][BF4], exhibiting an equilibrium within 60 minutes of EDS reaction and the removal time of 40 mins was examined to be optimal, which resulted in the highest sulfur removal for DBT. A sulfur extraction rate of nearly 74% is achieved within just 10 minutes of OEDS (containing 1 % v/v H2O2) under the same effective conditions as that of EDS. Temperature directly affects the kinetic rate constant of the DBT removal reaction, which results in higher DBT removal efficiency and 40oC was selected as the highest temperature. A high volume fraction of IL to model oil (1:1) directed to a remarkable increase of 7.18 % in desulfurization efficiency from 70 % (unreacted H2O2) to 77.18 % (with H2O2). Desulfurization efficiency was further increased by 4.3% when H2O2 concentrations ranged from 1 % v/v to 10 % v/v. Furthermore, findings from this experimental research indicates that [C6Py][BF4] is capable of being regenerated and can be reused up to 8 cycles without a significant loss in desulfurization efficiency. **Keywords:** Ionic Liquid; Euro V; Diesel Oil; Desulfurization Efficiency; DBT Extraction

Technical Session 1-A | **ADVANCES IN SUSTAINABLE MECHANICAL ENGINEERING**

SOLAR POWERED STIRLING ENGINE FOR DOMESTIC HOUSEHOLD AND RURAL AREAS IN KARACHI, PAKISTAN

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Due to energy crisis, there is a strong need to utilize the solar energy which is abundantly available everywhere. This study is focuses to use the solar powered Stirling engine for domestic use in the Karachi, Pakistan. In order to address the problems with home and rural areas' power generation, the design was carried out to provide a power output of 5 kW. MATLAB was used to simulate the design. The outcomes looked good. The primary features of the design included the usage of solar energy as the engine's heat input. This made it possible to design the engine for places with a lot of solar radiation. Solar cookers, sun air heaters, and other devices have the potential to be used in areas with ample solar energy. However, the Stirling engine was chosen for power generation. It was determined through calculations of the solar intensity that 12 kW of solar power would produce 5 kW of Stirling engine output. A solar parabolic dish was chosen as the concentrator for converging and reflecting the incoming radiations to the Stirling engine. Heat was gained by the working fluid in the engine through this process, which led to the engine's power strokes by causing it to expand and compress through thermodynamic processes.
Keywords: Solar energy; Stirling engine; Schmidt analysis; Beale number

Day & Date: Thursday 11th May, 2023, Time: 9:30 am - 11:10 am
Technical Session 1-B
Civil AV Conference Hall
"Emerging Areas of Mechanical and Aerospace"
"Additive Manufacturing Prospects in Third World Countries"

Technical Session 1-B | **EMERGING AREAS OF MECHANICAL AND AEROSPACE**

PERFORMANCE AND EMISSIONS ANALYSIS OF A DIESEL ENGINE FUELED BY DIESEL MIXTURES WITH MANGANESE OXIDE NAD CARBON NANOTUBES FUEL ADDITIVES

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To improve the quality of the air we breathe, internal combustion engine emission standards are getting stricter and stricter. Modern diesel emission control technologies concentrate on reducing particulate matter and nitrogen oxide emissions. Diesel emissions were said to be reduced with nanoparticle additions. Diesel fuel can burn cleanly because of engine advancement and diesel fuel formulation. The experimental study is concentrated on the impact of adding nanoparticles to diesel fuel, such as manganese oxide and multi-walled carbon nanotubes. Manganese oxide and multiwalled carbon nanotubes were added to pure diesel in a concentration of 90 ppm each. The experiments were carried out on a four-stroke diesel engine. The performance and emission parameters were recorded at engine speeds of 1200, 1400, 1600, 1800, 2000, and 2200 rpm. The performance of diesel fuel with nanoparticles addition showed a significant improvement. The brake thermal efficiency of the diesel engine increased by 10.62% when both manganese oxide and carbon nanotubes were added to pure diesel in a concentration of 90 ppm each. Diesel fuel with a nanoparticle addition demonstrated significantly lower levels of pollution emissions in exhaust emissions. The unburned hydrocarbons decrease maximum by 8.43% when carbon nanotubes were blended with pure diesel. Carbon monoxide emissions were reduced by 20.34% with carbon nanotubes at an engine speed of 1800 rpm. There was a 6.2% reduction in NOx emissions when both manganese oxide and carbon nanotubes were used at a concentration of 90 ppm each.
Keywords: Diesel Engine; Nanoparticles; Manganese oxide; Multiwalled carbon nanotubes; Emissions; Performance

Technical Session 1-B | **EMERGING AREAS OF MECHANICAL AND AEROSPACE**

MODELING OF SURFACE ROUGHNESS AND OPTIMIZATION OF CUTTING PARAMETERS FOR MILLING OF 42CrMo4 BY COATED CARBIDE TOOL INSERTS

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Machining is considered as the backbone of the manufacturing sector. By the advancement of technology and its implementation in the field of manufacturing, establishment of optimized cutting parameters for machining of various materials is the basic requirement for high quality and energy efficient machining with minimum cost and time. Surface roughness in machining (normally denoted by 'Ra') is not only the main indicator for the surface quality but also helps in achieving close dimensional tolerances of machined parts. The parameters which control surface roughness include rate of feed (f), spindle speed (v), depth of cut (DoC), material of insert and tool holder, tool geometry and cutting oils etc. With the introduction of automation and Artificial Intelligence (AI) and Machine Learning in the machining sector, accurate predictive models using techniques such as Response Surface Methodology (RSM) will help in selecting optimum parameters of machining to achieve desired surface roughness. This will ultimately help in enhancing productivity quality, efficiency and economy. In this research, average surface roughness (Ra) mathematical model has been developed for milling very popular steel type namely 42CrMo4 in free forged and hardened form using mechanical cutter clamped with multilayer coated carbide inserts TPKN-2204. A sequence of experiments using the response surface methodology (RSM) have been conducted to obtain a relationship between milling parameters (i.e., f, v & DoC) and Ra. Contour plots and surface plots of interactions among the cutting parameters have been developed for 42CrMo4 which identify that a target Ra can be achieved through optimum combination of the above mentioned milling parameters with a confidence interval of 95%. The confirmation of validity of the developed model has been done afterwards through conducting three experiments with an avg. prediction error of 2.08%.

Keywords: Surface roughness; dimensional tolerances; cutting parameters; Response Surface Methodology (RSM)

Technical Session 1-B | **EMERGING AREAS OF MECHANICAL AND AEROSPACE**

SIMULATION-BASED MODAL ANALYSIS OF CRACKED CANTILEVER BEAM

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Any structure with a crack is likely to crumble based on the type of vibration. The resonance created by the natural frequency leads to the failure of the structure. In this modal analysis study, twenty-seven models of a cracked cantilever beam with the crack parameters; crack location, depth, and height have been created on SolidWorks, and its simulations have been done to study its natural frequency over six modes. An uncracked beam has also been compared to analyze the study. As the cross-section area of the beam is square, the frequency of the two modes is similar because it has symmetry. And is clear from the study that the beam's natural frequency reduces due to the presence of the crack. A statistical analysis has been performed on Minitab software to analyze which parameter affects the most of the natural frequency of cracked cantilever beam.

Keywords: Modal analysis, Natural frequency; Vibration; Cracked beam.

Technical Session 1-B | **EMERGING AREAS OF MECHANICAL AND AEROSPACE**

DESIGN, FABRICATION AND STUDY OF REINFORCED ARC WELD JOINTS

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This study investigates the effects of using smooth and knurled high-carbon spring steel pins as reinforcement in arc welding of ASTM A36 structural steel. The purpose of this study is to compare the mechanical properties of welded samples with and without reinforcement, and to determine the effect of surface roughness of the reinforcement pins. Three sets of samples were prepared: solid metal, welded metal without reinforcement, and welded metal with reinforcement pins. Tensile tests were performed on each set of samples using ASTM E8 standard test methods. The results showed that the use of reinforcement pins significantly improved the mechanical properties of the welded joints, and the knurled pins provided better reinforcement than smooth pins. The increase in surface roughness of the reinforcement pins resulted in improved mechanical properties of the welded joints. These findings suggest that high-carbon spring steel pins with surface roughness can be a promising reinforcement material for arc welding of structural steel.
Keywords: Arc Welding; Reinforcement; Spring steel pins.

Day & Date: Thursday 11th May, 2023, Time: 11:30 am - 1:10 pm
Technical Session 2-A
Mechanical AV Conference Hall
"**Renewable and Alternate Energies**"

Technical Session 2-A | **RENEWABLE AND ALTERNATE ENERGIES**

A NOVEL STUDY ON PERFORMANCE EVALUATION OF SINGLE FLOW DOUBLE PASS SOLAR AIR HEATER WITH PHASE CHANGE MATERIALS

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Solar air heater (SAH) collects heat from the sun's rays, transfer it to the working substance, and then use the heated fluid for a variety of purposes. The performance of a double-pass SAH is compared and examined in the current paper using a V-corrugated absorber panel. For storing extra solar energy and releasing it at night, this work's goal is to construct and test a double-pass solar SAH with a thermal energy storage system in Multan, Pakistan. To assess the efficiency of a double-pass SAH the air flows at different masses ranging between 0.03 kg/s to 0.05 kg/s, and experimental work was carried out. When the air flows at the rate of 0.03 kg/s, the phase change material's extreme temperature changes between the input and output air flow was 31 °C. For the equal flow of air, the average effectiveness of double-pass SAH comprised with thermal storage is more than that of the double-pass SAH without thermal storage. Low mass flow rates can offer heat for a longer period by making use of the storage system's maximal capacity. Additionally, 0.03 kg/s is the suggested range for air mass flow rate that provides an acceptable efficiency and beneficial heat gain.
Keywords: Radiations; Phase change material; Paraffin wax, Copper oxide nanoparticles; Solar air heater

Technical Session 2-A **RENEWABLE AND ALTERNATE ENERGIES**

NUMERICAL INVESTIGATION OF SMALL-SCALE WIND TURBINE FOR COMMERCIAL BUILDINGS

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Due to the increasing demands for energy, depletion of fossil fuels, and climate change, wind turbines appear to be good alternatives to extract energy from wind because of its availability at the cheapest.This study seeks to conduct a numerical analysis of small Savonius wind turbines that could contribute to the energy consumption of commercial buildings.In this study, the drag-type VAWT, Savonius wind turbine, with twist angle of 45 degrees is employed for the analysis of the consequence of velocity on the coefficient of performance and torque coefficient for the commercial buildings of Islamabad. Numerical results were carried out with wind speed ranging from 2m/s to 3.25m/s with step of 0.25m/s. Results obtained shows that the maximum Cp for Savonius wind turbine obtained can never be more than 0.3. Maximum Ct was obtained at wind speed of 2.5m/s and power of turbines increases with increase in speed of wind, hence more wind energy can be converted into electrical energy at high speeds.

Technical Session 2-A **RENEWABLE AND ALTERNATE ENERGIES**

EFFECT OF FLOW RATE ON VARIOUS PARAMETERS OF ARCHIMEDES SCREW WATER TURBINE USING EXPERIMENTAL AND CFD ANALYSIS

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Archimedes screw water turbine(ASWT) is the efficient technology to harness energy from water flowing at a low head.This turbine is usually installed where changing of flow rate is significant. This study investigates, how the power output of Archimedes Screw Turbines (AST) is affected at different flow rates.Computational Fluid Dynamics(CFD) simulations on ANSYS Fluent are performed to analyze the effect of flow rate on power output that is comprised of analysis of angular velocity, pressure, and torque. The experimental results of power output and efficiency at varying flow rates are compared to ANSYS numerical results and final the results are shown in plotted graphs. From CFD analysis, the maximum power output value at flow rate (42 L/s) is 175.26 watts, while corresponding experimental values of power output on the same flow rate (42 L/s) is 168 watts Similarly, the efficiency which is obtained from numerical results is 92.17% at a flow rate of 36 (L/s), while corresponding experimental values of efficiency on the same flow rate (36 L/s) is 90.8 %. Since, there are minor variations between experimental and numerical results which validate the model.
Keywords CFD, Torque, Fluent, Angular Velocity, Pressure

Technical Session 2-A **RENEWABLE AND ALTERNATE ENERGIES**

PHOSPHORIC ACID FUEL CELL BASED CCHP SYSTEM FOR A SUSTAINABLE COMMERCIAL FARM AND CROP RESEARCH FACILITY

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This paper analyses the technical and economic feasibility of introducing a Phosphoric Acid Fuel Cell (PAFC) based Combined Cooling, Heating and Power (CCHP) system to supply an agriculture farm, a crop research facility and the surrounding residential areas with electric power and heat. In the controlled system considered, PAFCs are used in conjunction with solar panels and biomass power plants to generate power. In this thesis, PAFCs are chosen because of their impressive electrical efficiency (up to 70%) and moderate operating temperature (150℃ - 210℃). The latter is extremely important for the CCHP to successfully run. The overall efficiency of the fuel cell is further maximized by utilizing the waste heat from the cell effluents as input for absorption chillers. The novelty of the design considered is that the fuel cell has an external reformer, which extracts hydrogen from ethanol rather than methane gas. Plus, waste heat from the biomass power plant and the fuel cell stack makes it possible to run a heat-driven refrigeration cycle that produces a cooling effect by recovering low-temperature waste heat. The proposed PAFC system along with its control schemes is modelled and simulated on MATLAB/Simulink software.
Keywords: Phosphoric Acid Fuel Cell, CCHP; Hydrogen Fuel; Cogeneration; Biomass-based Power Generation

Day & Date: Thursday 11th May, 2023, Time: 11:30 am - 1:10 pm
Technical Session 2-B
Civil AV Conference Hall
"Localization, Entrepreneurial, and Commercialization Case Studies"

Technical Session 2-B | **LOCALIZATION, ENTREPRENEURIAL, AND COMMERCIALIZATION CASE STUDIES**

ENVIRONMENTAL AND FINANCIAL FEASIBILITY OF A SOLAR-POWERED AIR-CONDITIONING SYSTEM FOR A PASSENGER TRAIN IN PAKISTAN

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The study focuses on designing a stand-alone solar system for the air-conditioning system of a passenger train, specifically the 10DN Allama Iqbal Express which travels from Sialkot to Karachi. The maximum cooling load of the passenger train cabin was calculated using the HAP software, and a compressor was selected based on ASHRAE MT RGT 95 F Standard, requiring a power input of 9.95 kW. The stand-alone solar system was designed in PVsyst software for a power requirement of 10.95 kW, including a factor of safety for power production and inverter power loss. An inverter was introduced to provide AC to the compressor. Carbon emission reduction and payback period for the usage months of the system were calculated, and the results showed that the stand-alone solar system resulted in the reduction of 17.4 metric tonnes of carbon emissions. Furthermore, the payback period of 4 years and 4 months indicated that the system can be financially viable over its lifespan. Overall, this study highlights the environmental and financial feasibility and potential benefits of using stand-alone solar systems for passenger trains in Pakistan, underscoring the importance of considering renewable energy sources for powering trains.
Keywords: stand-alone solar system; Hourly Analysis Program (HAP); PVsyst

Technical Session 2-B | **LOCALIZATION, ENTREPRENEURIAL, AND COMMERCIALIZATION CASE STUDIES**

INVESTIGATION OF FLUID ELASTIC INSTABILITY EFFECT ON GROOVED TUBE HEAT EXCHANGER USING IN-LINE SQUARE ARRANGEMENT

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This research paper is related to fluid elastic instability in the heat exchanger, which is taken from the groove tube an in-line square tube bundle arrangement with a P/D ratio of 1.28 and a subsonic wind tunnel is used with single-phase cross flow. The tube vibration is measured through an accelerometer which is attached to the groove tube. The streamwise and transverse direction instability is almost the same until reduce velocity is 28.5 m/s, however when the reduced velocity cross 35.5 m/s, the transverse direction amplitude response is indicated as higher than the streamwise direction for all rows. The maximum resultant amplitude response is 1.13 percent of the tube diameter indicated in the third row, which is higher than the fourth and second rows. The fourth and second rows of the resultant amplitude response indicated 0.593 percent of tube diameter and 0.497 percent of tube diameter at a reduced velocity is 69.8 m/s.
Keywords: In-line Square Tube Arrangement; Fluid-Elastic Instability; Groove Tube; Reduce Velocity; Heat Exchanger

Technical Session 2-B | **LOCALIZATION, ENTREPRENEURIAL, AND COMMERCIALIZATION CASE STUDIES**

COMPARATIVE STUDY FOR SELECTION OF SUPPLIERS USING MCDM TOOLS

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Selection of suitable contractors according to the nature of the job remains a crucial problem in the construction industry. In most cases, the decision-makers are being criticized for wrong or biased qualification/selection of the contractor. There must be a standardized computational model for the selection of the contractor under a versatile and complex environment. Thus, the method is adaptable to the concerned stakeholders. This research prioritizes the selection criteria for Suppliers in Construction projects and develops a standardized computational model combining AHP and TOPSIS techniques for a robust selection of contractors for every edifice engineering. A case study of Supplier Selection (SS) at a renowned public sector organization i.e. Heavy Mechanical Complex of Pakistan, underneath the facility of the Public Procurement Regulatory Authority (PPRA) has been investigated in detail. By using the Analytic Hierarchy Process (AHP) the organized conferences were planned with the qualified experts in order to examine the comparative reputation weights against the particulars of the suppliers which have composed during the first phase. AHP is applied to create a precise result against the weights of contractor's parameters. Another tool i.e. Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) is used to assess and identified the suppliers attributes against engineering projects. Finally, the intimacy based on the suppliers' factors/numbers are calculated & assessed to get the best performance with regards to project execution. The main purpose of this research is to create such model by using the Multi Criteria Decision Making (MCDM) techniques which is helpful to scrutinize the appropriate contractor in every organization for the successful execution and completion of the projects in engineering field. Further, the planned methodology based on PPRA guidelines has been functioned in supplier selection to confirm the fruitful enactment against projects. The established methodology is constructed on the combination of AHP-TOPSIS, provided a standardized approach towards SS, thus adaptable to public sector organizations as well as private companies.

Keywords: MCDM, AHP, TOPSIS, Supplier Selection, Software, Hydro Power Plant, Research Methodology

Technical Session 2-B | **LOCALIZATION, ENTREPRENEURIAL, AND COMMERCIALIZATION CASE STUDIES**

DEVELOPMENT AND PERFORMANCE STUDY OF LAB SCALE CONTINUOUSLY STIRRED TANK REACTOR FOR BIOGAS PRODUCTION

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Anaerobic digestion is widely used technology for biogas production. Considering the current scenario of the Natural Gas scarcity in Pakistan, dire need to explore more substrates for their potential for biogas production is an urgent issue. In this study, a lab-scale Continuously Stirred Tank Reactor (CSTR) was developed for biogas production from anaerobic digestion with a five-litre capacity. In CSTR, anaerobic digestion (AD) was performed by using different substrates including cow dung, kitchen waste and fruit waste. Results showed that with cow dung and water as substrate in ratio 50:50, 465 ml of total biogas was produced in the total retention time of 18 day and the methane yield was 47.937%. The second experiment conducted contained kitchen waste, cow dung and water in the ratio 25:25:50, the total biogas yield was observed to be 520ml and the methane yield was 52.467%. The third experiment conducted contained Fruit waste, cow dung and water in the ratio 25:25:50 the total biogas yield was observed to be 384 ml and the methane yield was 53.747%.

Keywords: Anaerobic Digestion, Biogas, Renewable Energy, CSTR Reactor.

Day & Date: Thursday 11th May, 2023, Time: 2:00 pm - 3:20 pm
Technical Session 3-A
Mechanical AV Conference Hall
"Material Science and Nanotechnology from Economic Perspective"

Technical Session 3-A | **MATERIAL SCIENCE AND NANOTECHNOLOGY FROM ECONOMIC PERSPECTIVE**

THERMAL ANALYSIS OF SHELL AND TUBE HEAT EXCHANGER AND ITS OPTIMIZATION USING DIFFERENT MATERIALS

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Shell and tube heat exchangers are widely used in various industrial processes for heat transfer between two fluids. This paper presents an analysis of a shell and tube heat exchanger using a computational model created in ANSYS FLUENT. The model closely resembles a commercial heat exchanger, and various parameters such as average surface temperatures, surface heat transfer coefficient, surface area, surface heat flux, and amount of heat transfer are calculated. The efficiency of the heat exchanger largely depends on various parameters, such as the tube material, flow rate, and design, which need to be optimized for better performance. The heat exchanger system is optimized by changing the tube material from aluminum to copper and steel. The results indicate that copper tubes are 3% more effective for heat transfer, while steel tubes are the least effective. This study provides valuable insights for designing efficient heat exchangers and improving their performance.
Keywords: Shell and tube heat exchanger; computational model; heat transfer co-efficient; heat flux.

Technical Session 3-A | **MATERIAL SCIENCE AND NANOTECHNOLOGY FROM ECONOMIC PERSPECTIVE**

STRETCHING ANALYSIS OF COPPER THIN FILM WITH BS-8599 V7 RTV SUBSTRATE USING COMPUTER SIMULATIONS

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Microelectromechanical systems (MEMS) are the systems which has at least one dimension in the scale of micro meters. These are very sophisticated systems which are now extensively used in stretchable and flexible applications. Metal thin films with polymer substrate are being used in fabrication of multiple microelectronic devices, opto-electronics and optical devices. Polyethylene terephthalate (PET) and Polydimethyl siloxane (PDMS) have been extensively used as substrate for multiple stretchable and flexible microelectromechanical systems (MEMS) applications but now we can consider some other alternatives due to their increasing cost and availability issue. In this study, we are considering BS-8599 V7 Room Temperature Vulcanized elastomer as alternate substrate and Copper metallic thin film. FEA model of this laminate is studied numerically using commercial codes. Mesh independent results are obtained by applying uniaxial uniform strain on three different configurations. It will provide the estimates of stresses and strain for thin film materials. Results show that BS-8599 V7 RTV can be easily used as alternate of PDMS and PET because it generates approximately the same stresses by applying the specified strain.
Keywords: MEMS; Thin film; RTV; FEA

Technical Session 3-A | **MATERIAL SCIENCE AND NANOTECHNOLOGY FROM ECONOMIC PERSPECTIVE**

PERFORMANCE EVALUATION OF MULTI- NOZZLE PESTICIDE SPRAYER WITH CHAIN & SPROCKET MECHANISM

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Automation for spraying in the field of agriculture has increased the productive output of the farms. Owing to this, labour problem has been solved. But the scenario in the country like Pakistan is different. In the agriculture field, automation in such places is a difficult task also the economic condition of majority of Pakistani farmers is not well to do. Therefore, the manually operated sprayer finds wide application in such condition. Small scale farmers are very interested in manually lever operated knapsack sprayer because of its versatility, cost and design. In Pakistani farms two types of sprays are used: Hand operated and Fuel operated pump. The main drawn back of hand operated spray pump is that the user cannot use it for more than 5-6 hours continuously as he gets tired whereas fuel operated spray pump requires fuel which is expensive and availability of fuel is not easy at rural places. The suggested project of manually operated multi nozzle pesticides sprayer pump which will perform spraying at maximum rate in minimum time without necessity of fuel to operate and also reduce the fatigue to the farmer. **Keywords:** Chain & Sprocket mechanism; Mechanical Advantage; Multi-nozzle sprayer; Pesticide

Day & Date: Thursday 11th May, 2023, Time: 2:00 pm - 3:20 pm
Technical Session 3-B
Civil AV Conference Hall
"Retrofitting and Modification of Mechanical Structures and Systems"
"Reverse Engineering Practices and Case studies"

Technical Session 3-B | **REVERSE ENGINEERING PRACTICES AND CASE STUDIES**

PERFORMANCE AND EMISSION ANALYSIS OF A DIESEL ENGINE USING DIESEL MIXTURES WITH BIODIESEL AND CARBON NANOTUBES

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The current study explored how the performance and emission characteristics of a diesel engine would change if carbon nanotubes (CNTs) were added to diesel-biodiesel fuel. The B5 biodiesel blend was combined with the CNTs nanoparticles. The CNTs nanoparticles were dissolved into B5 using a magnetic stirrer at concentrations of 40, 60, and 80 ppm. Engine testing was done under varied conditions with a full load at 1200, 1400, 1600, 1800, 2000, and 2200 rpm. Investigations were made into performance and emission parameters, such ssas brake-specific fuel consumption (bsfc), torque, brake power, NOx, CO2, and CO. In comparison to D and B5, the results revealed that adding CNTs to B5 enhanced power by 8.95% and 9.29%. Additionally, compared to the D and B5, the average torque rose by 18.17% and 20.38%, respectively. Brakespecific fuel consumption dropped in comparison to D and B5 fuels by 6.25% and 8.57%, respectively. Despite the presence of CNTs in the fuel blends, for B5 the CO emissions were on average lower than the D by 2.37%. Additionally, compared to the D, CO2 emissions dropped by 11.61% for the B5 fuel blend.
Keywords: Engine Performance; Engine emissions; carbon nanotubes; biodiesel.

Technical Session 3-B | **REVERSE ENGINEERING PRACTICES AND CASE STUDIES**

OPTIMIZATION AND PERFORMANCE ANALYSIS OF NATURAL GAS-BASED COMBINED CYCLE POWER PLANT USING POST COMBUSTION PROCESS

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The major contribution to global warming and air pollution is the carbon dioxide emissions emitted from the thermal power plants that operate on hydrocarbon-based fuels. The use of fossil fuels in power plants and various industrial processes significantly increases carbon dioxide emissions to the atmosphere. The methodology used for this research is such that first of all the model of a combined cycle power plant is developed in ASPEN HYSYS software using a post-combustion process for CO2 capture. Furthermore, the model is integrated using the literature parameters and industrial operating data. The model is validated with the reference model of literature. Based on the results of this research, it was determined that 87% of CO2 was captured using a combined cycle power plant based on natural gas. Furthermore, the obtained result presents that by varying the temperature across compressor the maximum power generation value is 19.52 MW at gas turbine 1, 16.83 MW at steam turbine and 14.58 at gas turbine 2. The results is also obtained by varying the pressure across compressor. The output results highlights that maximum power generation is 5.99 MW at gas turbine 1, 1.775 MW at steam turbine and 1.20 MW at gas turbine 2. The model is further integrated by changing the mass flow rate across the source component (compressor). The obtained output results displays a maximum power generation of 742.2 MW at gas turbine 1, 102.3 MW at steam turbine and 92.98 MW at gas turbine 2. In last it is also concluded from this research, the amount of exhaust gas recirculation in the absorber and the pressure in the absorber both have a great impact on the requirement of energy.
Kewords: ASPEN HYSYS, CO2 capture, Gas turbine, Steam turbine.

Technical Session 3-B | **REVERSE ENGINEERING PRACTICES AND CASE STUDIES**

REDUCTION OF REWORK RATES IN MANUFACTURING OF DOMESTIC GAS METERS THROUGH THE IMPLEMENTATION OF DMAIC METHODOLOGY.

Ifrah Asif[1], Eylia Jaffery[2*], Syed Muhammad Abbas[1], Muhammad Ali Arshad[1], Hammad Ahmed Memon[1], Syed Shabbir Rehman[1,1]
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This study Process improvement is nothing but the understanding of an existing process and introducing process changes to improve quality of product, reduce costs, improve overall efficiency of process or accelerate productivity. Six Sigma is a structured and systematic approach to performance and quality improvement. It is a rigorous methodology that consists of five major phases i.e. define, measure, analysis, improvement and control for problem-solving. DMAIC helps in understanding the process and the variables that affect it so that can be optimized the processes. This paper gives a case study of Six Sigma deployment in a G-1.6 Meter Manufacturing plant with the goal of reducing the rework rate in the assembly line by implementing six sigma methodologies. A variety of tools and techniques like flow chart, histogram, Pareto diagram, analysis of FMEA (Failure Mode and Effect Analysis) data, cause and effect diagram logical analysis was used. Rework is one of the major concerns when it comes to production as it caters both loss of resources and time, thus overstretching the hours of production for the company. Applying Six Sigma methodology can bring about a drastic reduction in rework rate which will be both productive and profitable for the company. Since the goal in this case study was to improve an already existing system, therefore, DMAIC methodology of Six Sigma has been deployed.

Keywords: Six sigma; define, measure, analyze, improve and control; DMAIC; meter manufacturing plant, quality improvement, process improvement.

Technical Session 3-B | **REVERSE ENGINEERING PRACTICES AND CASE STUDIES**

DESIGN AND DEVELOPMENT OF COMPACT EQUIPMENT FOR THE GRADING OF MATERIAL COMPOSED OF DRY MICRO SIZE PARTICLES

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Solid-Solid microparticle separation from a carrying flow is a widely used industrial technique, various types of equipment are available in the market which facilitates the separation of solid- solid mixtures. This project aims to develop compact equipment that can be placed and used in a lab to perform solid-solid microparticle separation. Also, it has the potential to be replicated on a commercial scale to fulfill the needs of relevant industries. Vibratory Sifters type separators are used worldwide on a laboratory scale, but it involves several drawbacks like, it is a non-continuous process of separation as well as it involves the use of sieves which get clogged and need to be cleaned regularly. On the other hand, a cyclone separator is a particle separation apparatus that uses centrifugal force to sort particles based on their size. They are better than the devices which involve sieves for the separation since they are simple, continuous, and economical to use. Our design consists of two cyclone separators. The inverse cyclone separates the particles according to the size while the conventional is used to separate the fine particles from the airflow. To perform the experimentation kaolin clay was used as the input feed, and the aim is to separate particles having size < 89 microns. After the finalization of the design, fabrication of the equipment was done using Polyvinyl Chloride (PVC) as the main equipment material while wooden planks and Steel were used for the manufacturing of the frame. Finally, the equipment was tested in a controlled environment using Kaolin Clay. From the results, we concluded that the equipment is separating the fine particles from the clay sample at 97% accuracy of which ~75% fine size is <74 microns and ~23% fine collected passes through 100 mesh size sieves (<149 microns).

Keywords: Solid-Solid Mixtures; Reverse Engineering; Cyclone Separator; Kaolin

List of Papers Presented in 11th International Mechanical Engineering Conference held on 14th & 15th January, 2022 at IEP Karachi

Keynote Address by Dr. David White , Associate Professor, Auckland University of Technology, New Zealand

Technical Presentation on Home Office Ergonomics by Jeffery Fernandez, Managing Principal , JF Associate Inc. Fairfax Virginia USA

Keynote Address by Engr. Tariq A. Khan, Senior Director, CSRA, IMC & Group Director, Strategy Auto Engineering Group, House of Habib

Keynote Address by Dr. A. Raheem Othman, PETRONAS University Malaysia

"The effect of inlet swirl on thermal performance of curved vortex tube"
Shehzaib Yousuf Khan*, Usman Allauddin, Department of Mechanical Engineering, NED University of Engineering & Technology, Karachi, Pakistan

"Design and modelling of lower prosthetic limb for additive manufacturing
Muhammad Osama1*, Usman Allauddin2, 1 Industrial and Manufacturing Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan, 2 Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

"Why do we need improved wind speed forecasting models for small sample datasets?"
Muhammad Uzair Yousuf a,b a Department of Mechanical and Electrical Engineering, MasseyUniversity, Palmerston North, New Zealand b Department of Mechanical Engineering, NED University of Engineering and Technology, Karachi, Pakistan

"Simulation of three-dimensional laminar and turbulent flows over a cylinder undergoing vortex induced vibration"
Syed Ahmad Raza1, Yosua Heru Irawan2, Ming-Jyh Chern3, 1Department of Mechanical Engineering, NED University of Engineering and Technology, Karachi, Pakistan, 2Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan 3Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan

"Thermodynamic analysis of single effect and double effect vapor absorption refrigeration system"
Abdul Rehman and Syed Muhammad Ali Mazhar, Energy Research Lab, Mechanical Engineering Department, DHA Suffa University,, Karachi, Pakistan

"Assessment plan of indoor and outdoor relationship of nitrous oxides, sulfur dioxide, an particulate matters concentration level in four shanghai public schools"
Mirza Hammad Baig1*, Kashif Azher1, Katherine Hasan2 and Francine Lima, 1Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan
2CLASP, Indonesia

"Design and fabrication of catalytic converter with new material"
Muhammad Wajahat Rasool Arain 1, Asad A. Zaidi2, Muhammad Asif1, Muhammad Uzair3,* 1Department of Engineering Sciences, PNEC, National University of Science and Technology, Karachi, Pakistan 2Department of Mechanical Engineering, Faculty of Engineering Science and Technology, Hamdard University, 3Department of Mechanical Engineering, NED University of Engineering & Technology, Karachi

"Experimental study to analyse the effect of critical parameters on the performance of integrated solid desiccant using cross flow m-cycle"
Ghulam Qadar Chaudhary, Allah Ditta a, Dr. Muzaffar Alib, Dr. Muhammad Uzair b, Naveed Akram a Amar Gulnawaz Department of Mechanical Engineering, Mirpur University of science and Technology, Mirpur, AJK, Pakistan, Department Mechanical Engineering, NED University of Engineering & Technology University of Engineering and Technology Taxila, Punjab, Pakistan

"Ready to use virtual all-atom polarized model of gold compatible with forcite module"
Tariq Jamil and Shaukat Ali, Department of Mechanical Engineering, NED University of Engineering & Technology, Karachi

"Ideal resource mangement model (irmm) for atlas battery limited"
Syed Sohail Ibtihaj Bukhari, Maaz Akhtar, Muhammad Muzamil, Mechanical Engineering Department, NED University of Engineering & Technology, Karachi 75270, Pakistan

"Development of new creep material model for use through computational modelling"
Mohsin Sattar, A.R. Othman and S. Kamaruddin, Department of Mechanical Engineering, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia

"Single image frame algorithm for particle streak velocimetry"
Mumtaz Hussain Qureshi1,* and Wei-Hsin Tien2, 1 Department of Mechanical Engineering, NED University of Engineering & Technology, Karachi, Pakistan, 2 Department of Mechanical Engineering, National Taiwan University of Science & Technology, Taipei 1067, Taiwan

"Sizing of a novel off-grid mobile solar pv system"
Ahsan Ahmed1,*, Musab Salim Khan1, Faaiz Alavi1, Hassan Rasool1 and Hassan Ali 1Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

Increasing photovoltaic performance through temperature regulation by soy wax as phase change material"
Muhammad Farhan1, Asad A. Naqvi1*, Muhammad Uzair1 1Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

"Design and fabrication of small-scale solar panel lamination machine"
Usman Allauddin1*, Mirza Hammad Baig1, S.H. Siddiqui1, M.M. Aman2, M.W. Baqar1, T.A. Hussain1, M.A. Mohsin1 Mechanical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan Chemical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

"Future of gas turbines in power sector"
M. Aijaz Umer, Vice President, Central Technical Service (Conventional and CCGT Technology), ACWA Power International, Riyadh, Saudi Arabia

"Energy Efficient Practices for HVAC System Designs for High Performance Buildings"
By Fahim I Siddiqui

"An overview of Pakistan's Building Energy Code and the Role of ASHRAE"
By Farhan A. Mehboob

"Bangladesh changing its indoor environment with ASHRAE Standards"
By Ananta Ahmad

"Impact of waste cooking oil blend on exhaust gas temperature in compression ignition engine"
Faheem Ahemd Solongi1,* Liaquat Ali Memon2 Tamoor Abbas Larik3 Ali Murtaza Ansari4, Assistant Professor Mechanical Engineering Department, QUESTm Nawabshah, Professor Mechanical Engineering Department, QUEST, Nawabshah Assistant Professor Mechanical Engineering Department, Quaid-e-University of Engineering Science & Technology Larakana, Pakistan PhD Scholar Mechanical Engineering Department, QUEST, Nawabshah

"3D structural analysis of an electric vehicle chassis using computer simulations"
Hasan Raza1, Murtuza Mehdi1, Usman Allauddin1 and Nauman Malik2, Department of Mechanical Engineering, NEDUET, Karachi-75270 Pakistan., Faculty of Integrated Technologies, University of Brunei Darussalam, Bander Seri Begawan, BE 1410, Brunei Darussalam

"Study The Effects of Utilizing of Waste Thermoplastics in The Construction of Roads"
Ifrah Asif1, Asad A. Naqvi1*, Mubashir Ali Siddiqui1, Hammad Ahmed2 Department of Mechanical Engineering, NED University of Engineering and Technology, Karachi Department of Energy Engineering, Politecnico Milano, Milan, Italy

"Selection Of Fluid For Organic Rankine Cycle"
Asad A. Naqvi, Shaheer Ali, Hassan Shahid, Hasan Masroor, Anas Khan Department of Mechanical Engineering, NED University of Engineering and Technology, Karachi

POSTER PRESENTATIONS

"Thermal Analysis of Welding Heat Source on Metallic Materials"
by Mr. Arsalan Ahmd Khan,NEDUET

"Experimintal study of the new surface development additive for repairmen works"
by Mr. Muhammad Naveed Anwar,NEDUET

"Effect of tabulators and nanoparticles on the heat transfer enhancement of s olar parabolic trough"
by Dr. Usman Allauddin, NEDUET

"Design & analysis of hybrid PVT water collector"
by Mr. Asad Akhtar, NEDUET

"Strategies to Minimize energy usage of HAVC-AHU system"
by Engr. Ifrah Asif , NEDUET

"Identification of root causes of rework in the manufacturing of G 1.6 domestic gas meter "
by Engr. Ifrah Asif Balochistan

"Based information feed flow in sensors actuators, robotics, internet of things and artificial"
by Mr. Adan ul Haque, NEDUET

Glimpses of 11th International Mechanical Engineering Conference held on 14th & 15th January, 2022

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Forthcoming Confererences

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International Building Energy Efficiency Symposium (IBEES-2023)
12th & 13th May, 2023 at NEDUET, Karachi
Website: www.iepkarachi.org.pk
Contact Person: Engr. Dr. Farrukh Arif
E-mail: farrukh@cloud.neduet.edu.pk

International Conference on Sustainable and Smart Cities (ICSSC-2023)
14th & 15th June, 2023 at SSUET, Karachi
Website: www.iepkarachi.org.pk
Contact Person: Engr. Prof. Dr. Mir Shabbar Ali
E-mail: alimirshabbar@gmail.com

8th International Electrical Engineering Conference (IEEC-2023)
19th & 20th June, 2023
Website: www. ieec@neduet.edu.pk
Contact Person: Engr. Abdul Ghani Abro
E-mail: ghani@cloud.neduet.edu.pk

11th International Conference on Occupational Health, Safety & Environment ICOHSE-2023)
1st & 2nd September, 2023
Website: www.iepkarachi.org.pk
Contact Person: Engr. Ayaz Mirza
E-mail: ayaz.mirza@ke.com.pk

2nd International Conference on Sustainable Engineering & Development (ICSED-2023)
October, 2023
Website: www.iepkarachi.org.pk
Contact Person: Engr. Prof. Dr. Abdul Jabbar Sangi
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2nd International Biomedical & Digital Health Conference (IBDC-2023)
October, 2023
Website: www.ibdc.neduet.edu.pk
Contact Person: Engr. Dr. Eraj Humayun Mirza
E-mail: erajhumayun@hotmail.com

13th International Civil Engineering Conference (ICEC-2023)
10th & 11th November, 2023
website: www. icec@neduet.edu.pk
Contact Person: Engr. Prof. Dr. Abdul Jabbar Sangi
E-mail: ajsangi@neduet.edu.pk

4th International Conference on Advance Materials & Process Engineering (AMPE-2023)
December, 2023
Website: www. nedampe.com
Contact Person: Engr. Prof. Dr. Saud Hashmi
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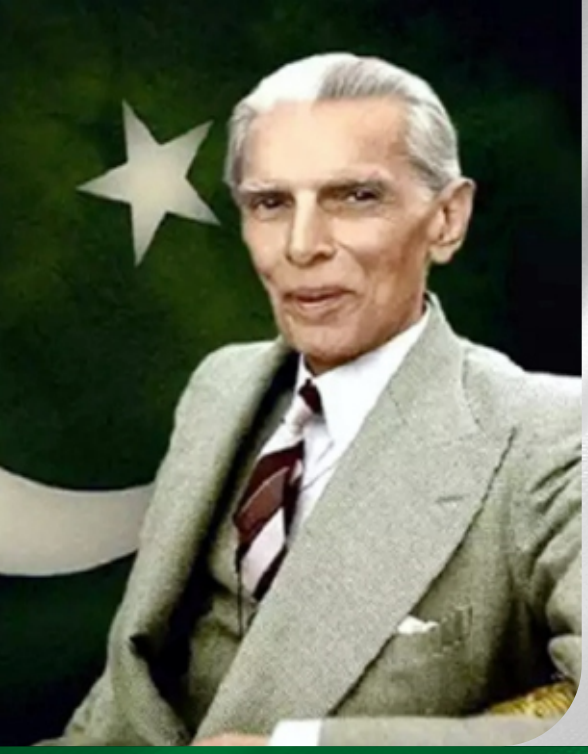

FATHER OF THE NATION

Quaid-e-Azam Muhammad Ali Jinnah
Message on the occasion of
Foundation Stone Laying Ceremony of the
Institute of Engineers Pakistan, Headquarters
at Dacca on 30th May, 1948

"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"