IC4M 2021

INTERNATIONAL CONFERENCE

Advances in Materials, Mechanics, Mechatronics and Manufacturing

March 6-7, 2021 / India

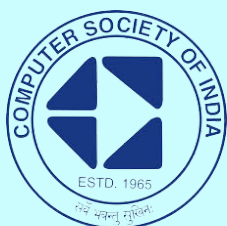## Organized By

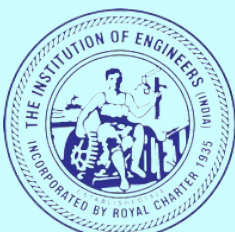ajurvedam
An Association for Educational
Empowerment & Social Welfare

GAI
Mark of Quality
Estd. 1975

Our Associates

BIRMINGHAM CITY
University,UK

INDIAN INSTITUTION OF INDUSTRIAL ENGINEERING
IIIE

MIA
Maharajpura Industrial Association (Regd.)

AMSI

CANADIAN CENTER
FOR INTER-ACADEMIC RESEARCH
& COMMUNICATION

IIW INDIA
DWE | EKAM

COMPUTER SOCIETY OF INDIA
ESTD. 1965
Gwalior Local Chapter

THE INSTITUTION OF ENGINEERS (INDIA)
INCORPORATED BY ROYAL CHARTER 1935
Gwalior Local Chapter

CONFERENCE E-SOUVENIR

IOP Conference Series
Materials Science and Engineering

About Conference

IC4M 2021 is an International Peer-reviewed Academic Conference on **Advances in Materials, Mechanics, Mechatronics and Manufacturing (4 'M's)** being organized online on **March 6 & 7, 2021**.The conference aims at providing a platform to discuss and exchange high quality academic research ideas among researchers, engineers, academicians, industrial professionals and practitioners from all over the globe.

This conference will focus to fetch the attention of industry and academia on the understanding of 4 'M's' and their interlinking in the present times.

Over last two decade the world is witnessing constructive changes due to technological advancements at an exceptional rate. Hence in an attempt to encourage young researchers, several world-renowned experts have been invited from the thematic areas to share their years of knowledge and wisdom during the plenary lecture sessions with the participants. Conference also aims to provide an opportunity for the participant researchers to discuss the topics among themselves and enhance their knowledge in the respective domain.

IC4M 2021 would not just be a conference but a great online meet up for all the technocrats. It will help provide the ground for future high quality research collaborations from across the world enhancing the precision of work in the field of 4 'M's.
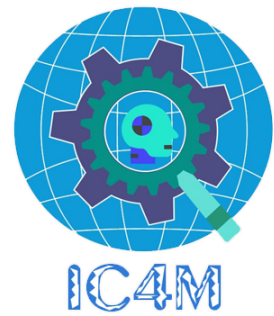
Message from Vice-Chancellor

All of us at **Birmingham City University** would like to extend our best wishes for the Conference this year.

It is our pleasure to be involved with the event, particularly when the organisers share our belief of the importance of education as a tool for empowerment, social development and transformation.

We are proud to have many fruitful partnerships across India and I have no doubt that the Conference will be the latest activity to enhance and enrich the University's presence in India.

We wish you every success.

Professor Philip Plowden

Vice-Chancellor
Birmingham City University, UK

Professor Philip Plowden

Dr. Chinmay Pandya

(MBBS, PGDipl, MRCPsyche – London)
Pro Vice Chancellor, Dev Sanskriti
Vishwavidyalaya, Gayatrikunj, Haridwar

Dear Hosts, Participants & Collaborators

I am glad to note that **Yajurvedam: An Association for Educational Empowerment and Social Welfare and M/s Gayatri Auto Industries** are organizing **International Conference on Advances in Materials, Mechanics, Mechatronics and Manufacturing (IC4M 2021)** during **March 06-07 2021**.

It is a matter of great pride that this prestigious conference is being hosted by joint collaboration of Birmingham City University (UK), Canadian Centre (Canada), Mahrajpura Industrial Association, Gwalior; Indian Institute of Welding, Indian Institution of Industrial Engineering, Additive Manufacturing Society of India, Institution of Engineers (Gwalior Chapter), and Computer Society of India (Gwalior Chapter).

May the blessings of Vedmurti Taponisht Param Pujya Gurudev & Param Vandaniya Mataji make this event successful.

Dr. Chinmay Pandya

Message from Dr. V K Jain
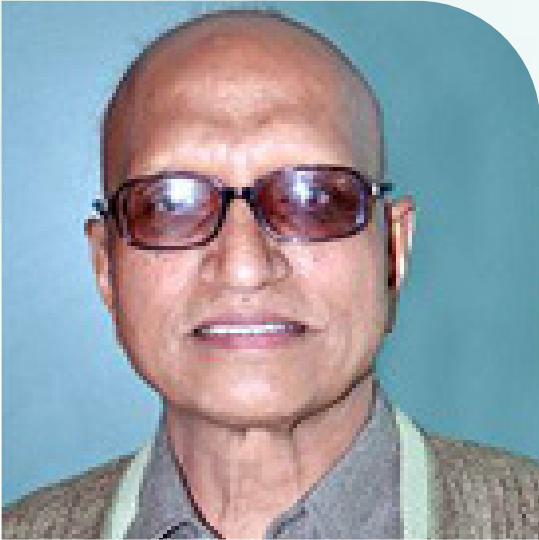
Dr. Vijay Kumar Jain

Professor (Retd.)
Indian Institute of Technology Kanpur, INDIA

I am happy to see that the International Conference on **ADVANCES IN MATERIALS, MECHANICS, MECHATRONICS AND MANUFACTURING (IC4M2021)** is being organized.I hope that the participants will be benefitted by learning the new research activities going on in 4 M (Materials, Mechanics, Mechatronics and Manufacturing) areas across the globes. Also, the participants (faculty members, research scholars, PG scholars, industry personnel and practitioners) will have opportunity to on-line interact with the experts who are going to present their research work from different parts of the world.I am sure they will have an excellent opportunity sitting at home and listening different experts of their fields. I will definitely like to mention that such activities will be more useful especially for the developing and under developed countries if they can introduce new subjects in their undergraduate and postgraduate curriculums based on these new developed / developing areas. I hope you will agree with me that "No country can be economic leader unless they are in the forefront of R & D activities". For that, you need researchers and scientists who are 'Honest, sincere, hardworking and have Junoon (passion) towards their goal'. To be a successful researcher / scientist, you have to be keen observer.

With these words, I wish all the best to the organizers of IC4M-2021 in terms of very good response from the speakers as well as audience (participants).

Dr. Vijay Kumar Jain

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Message from Director, REC Mainpuri

Dr. Jitendra Kumar Sharma

Director
Rajkiya Engineering College, Mainpuri, India

It's a matter of pleasure that "An International Conference on **Advances in Materials, Mechanics, Mechatronics and Manufacturing (IC4M-2021)**" is being organised by **'Yajurvedam: An Association for Educational Empowerment & Social Welfare' and 'Gayatri Auto Industries'** jointly on 06-07 March, 2021.

I wish that IC4M 2021 will bring together the National and International talents focusing on excellent opportunities for researchers, scientists and industrialists to share and converse on the recent advancements in the areas of Mechanical Engineering, Mechatronics and Materials Science. Undoubtedly, Mechanical Engineering has played a key role in transforming our society to a "high tech" in the recent decades and the pace of change can only be described as constructive. The Technology itself is progressing and exploring new horizons.

I hope eminent speakers will cover the theme of Materials, Mechanics, Mechatronics and Manufacturing from different perspectives. I am privileged to say that this conference will definitely offer suitable solutions to the global issues.

I congratulate the organizing team of IC4M-2021 and wish that the conference will be a great success and help in improving productivity, product quality and safe working environment in the applied fields for the society at large.

Dr. Jitendra Kumar Sharma

Message from President, Additive Manufacturing Society of India

Dr. L. Jyothish Kumar

President
Additive Manufacturing Society of India

I am delighted to know that '**Yajurvedam: An Association for Educational Empowerment & Social Welfare'** and '**Gayatri Auto Industries'** are jointly organizing an I**nternational Conference on Advances in Material Mechanics Mechatronics & Manufacturing on March 06 & 07, 2021.** This Conference will further enhance the knowledge of faculty, research scholars and industry professionals.

In today's competitive world it is very significant to understand, learn and adopt the latest develoments of manufacturing, materials and related softwares to be on par with global manufacturing peers.

I wish the International Conference on Advances in Material Mechanics Mechatronics & Manufacturing conference a grand success and it provides a great platform to network and foster new technological collaborations to all the participants.

Dr. L. Jyothish Kumar
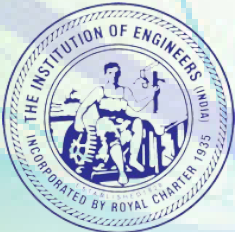
Message from Vice President

Warmest greetings to the organizers of International Conference on **Advances in Materials, Mechanics, Mechatronics and Manufacturing (IC4M 2021)**.

I am confident that the conference will definitely provide valuable knowledge and will be very useful for young and those who are working in the same platform. I would like to congratulate the organizers of the conference for selecting the subject which will give new direction and more knowledge.
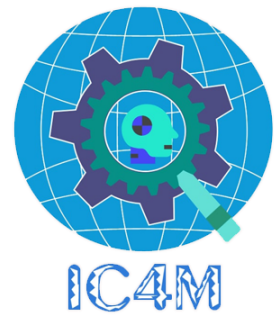
My best wishes and full support to organizers and wish you all good luck.

Dr. Jayant S Bhide

Regional
Vice President Region III
Computer Society of India

Dr. Jayant S Bhide

Message from Vice Chairman

I am extremely happy and pleased to learn that an International Conference on **Advances in Materials, Mehcanics, Mechatroincs and Manufacturing** is being organised on 6 – 7 March' 2021 viz IC4M (2021) with so many International Institutes of repute.

The Conference topics are of immense use for the Education World, Research, Industry and for the Society.

On this occasion, my wish is that it meets its objects and I further hope all the best and a very successful conference.

Er. R.K.Khetan
Vice Chairman
Gwalior Local Centre
The Institution of Engineers (India)

Er. R.K.Khetan

Message from Conference Chair

Dr. Ravi K Dwivedi

Professor, Maulana Azad National Institute
of Technology
Madhya Pradesh, India

On behalf of the organizing committee, it is with great pleasure to welcome you to the **International Conference on Advances in Materials, Mechanics, Mechatronics and Manufacturing (IC4M 2021)**. IC4M has become the preeminent international forum on embracing all aspects from Fatigue and Fracture Mechanics, Modeling and Simulation, Reliability Analysis, Artificial Intelligence, Machine Learning, Medical Robotics, Mechatronics Design Control System, Advanced Construction Materials, Biomaterials, Composite Materials, Additive Lean & Green Manufacturing, CAD, CAE and CAM and many more.

This time, the conference offers five keynote speakers by distinguished persons in their own fields.

We are proud to have Prof.(Dr.) Nageswara Rao Posinasetti, Professor, University of Northen Iowa, USA, Prof. Dr. Raghu Echempati, Professor, Kettering University, USA, Prof. (Dr.) V. K. Jain, Professor (Retired), Indian Institute of Technology Kanpur, INDIA, Dr. Rohan Shirwaiker, Associate Professor, N C State University, USA, he is also Associate Director, Functional Tissue Engineering Program, Comparative Medicine Institute (CMI), USA, Prof.(Dr.) Anjali Awasthi Professor, Concordia University, Montreal, Canada as our keynote speakers.

The conference proceedings provide views into the current advances in the field of 4 'M's' i.e. Materials, Mechanics, Mechatronics and Manufacturing and how they are interlinked with the current scenario and the conference helps to build a relation and transfer of research ideas. We look forward to the presentations of our participants.

To all participants, I hope we can gain knowledge and benefits from the conference while making new contacts with other participants.

Dr. Ravi K Dwivedi

Message from Conference Co-Chair

Dr. Premanand S Chauhan

Principal
IPS College of Technology and Management,
Gwalior

It is a matter of great pleasure that we are organizing an **International Conference on Advances in Materials, Mechanics, Mechatronics & Manufacturing on March 06 & 07, 2021**.

In the progress towards excellence in the field of materials, mechanics, mechatronics and manufacturing technology, new innovations and developments need to be shared and disseminated for ensuring continuous advancement and knowledge creation. Therefore it is my hope that the conference will provide a platform for exchange of noble ideas among researchers, academician and industrial practitioners all over the country and abroad.

This conference bears all the hallmarks of success. This is due to the great team work from international and national advisory committee members and organizing team members who I owe a deep depth of gratitude.

I am grateful to the associates of IC4M 2021 Birmingham City University UK, Canadian Centre for Inter Academic Research and Communication, Canada, Indian Institute of Welding (India), Indian Institution of Industrial Engineering, Additive Manufacturing Society of India, Maharajpura Industrial Association, Computer Society of India (Gwalior Local Chapter) and the Institution of Engineers (Gwalior Local Chapter) for their generous support in organizing this conference. I pay my sincere regards to IOP Publishing for bringing out the proceedings. My thanks to members of the technical committee and reviewing committee for helping in the review of papers. Thanks to the promotional committee whose help is deeply appreciated.

Thanks to the printing committee for bringing out the fantastic souvenir which shares the highlights from IC4M 2021, gives sketches of keynote speakers, contains abstracts of all papers and photographs of all major volunteers.

Last but not the least are the authors whom I thank sincerely for contributing good papers and for attending this conference.

I sincerely hope that all the participants will actively deliberate in the conference and come out with recommendations for emerging trends in Materials, Mechanics Mechatronics & Manufacturing.

I extend my very best wishes for the success of the conference.

Dr. Premanand S Chauhan

Message from Coordinator

Dr. Avadesh K Sharma

Associate Professor
Rajkiya Engineering College, Mainpuri, India

On the behalf of organizing committee of **"International Conference on Advances in Materials, Mechanics Mechatronics and Manufacturing (IC4M-2021**), I extend a warm welcome to all the delegates from academia, research institutes and industries. The main aim of this conference is to provide an international academic forum to all the researchers, practitioners, professionals, faculty members and students in related field to share their knowledge and results from their experimental, analytical and computational work.

The Conference would consist of key note lectures from the various eminent speakers of international repute. Also there will be paper presentation by the participants from the country and abroad. Due to COVID-19 pandemic, we are organizing this conference through Online medium. We received more than 395 papers of which finally 77 good quality papers have been selected and registered. The papers cover a wide range of topics such as analysis and synthesis of mechanism, Finite Element Method, CFD, Computer assisted Manufacturing and Design, Composite Materials, Alternative Fuels, Engineering Mechanics, Mechanical Vibration, Mechatronics, Robotics and Simulation.

We express our gratitude towards reviewers from many institutions and research organisations for helping in the peer review of research papers.

It has been a great privilege for me to serve as a coordinator of IC4M-2021 and it's my hope that you will find the conference stimulating, fulfilling and enjoyable.

I convey my sincere thanks to all of you for your support and wish you a pleasant experience in this knowledgeable conference.

Dr. Avadesh K Sharma

Message from Organizing Secretary

Dr. Anupma Agarwal

Assistant Professor
IPS College of Technology and Management, Gwalior

I am greatly honored to serve as the Organizing Secretary of the IC4M2021 an **International Conference on Advances in Materials, Mechanics, Mechatronics and Manufacturing**. It gives me utmost pleasure to welcome you all on this virtual platform of IC4M2021.

This conference with the theme of Advances in Materials, Mechanics, Mechatronics and Manufacturing is the right platform to bring various stakeholders under one roof to discuss, exchange and explore the idea of technological advancement in the field of these four M's to make the life of people easier and more comfortable. Through this conference we put all our effort to drive the best practices of multi domain research on upfront. The plenary sessions by the eminent experts of their fields will surely stimulate the researchers to work on the most recent developments of technology.

I pay my gratitude to each and every one of you who has directly and indirectly associated with IC4M2021, provided their valuable services with full of dedication, presented their research ideas enthusiastically and making it a mega event of its kind. The enthusiasm shown by all the people associated in the organization of the conference is truly remarkable.

I look forward to working with our research community including authors, reviewers, editors, and publication staff to take the conference to the new horizon of success!

Hope you all will continue to support us in future programs and this splice of faith will be stronger every time.

Dr. Anupma Agarwal

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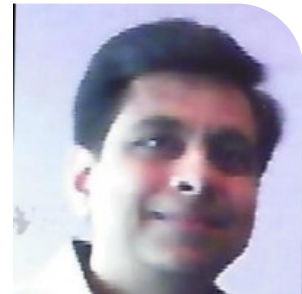King Khalid University, Saudi Arabia

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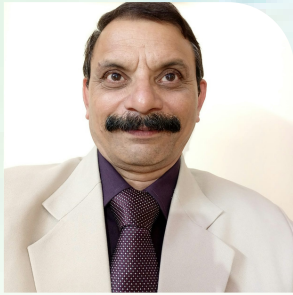**Mr. Sunil Khandelwal**

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Secretary
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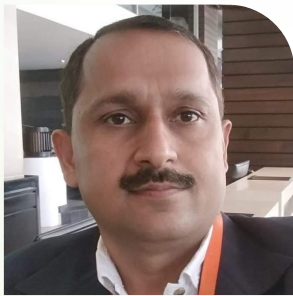
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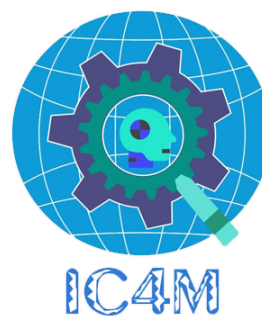
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Mr. Ram Kumar Agrawal, University of Technology, Jaipur, IN
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Mr. Ranjeet P S Bhadoriya, IPS College of Technology and Management, Gwalior, IN
Dr. Ravi K Dwivedi, Maulana Azad National Institute of Technology, Bhopal, IN
Dr. Ravi K Mandava, Maulana Azad National Institute of Technology, Bhopal, IN
Dr. Ruby Chakraborty, HOYA Optical Corp. & Entrepreneur at Biena Tec, USA
Dr. Sachin K Gupta, Indian Institute of Technology Madras, IN
Dr. Sanjay Mishra, Madan Mohan Malaviya University of Technology, Gorakhpur, IN
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Mr. Yogendra Singh Rajpoot, Rajkiya Engineering College, Mainpuri, IN

Programme Schedule

March 06, 2021 (Day 1)

Programme	Time/ Paper IDs
Inaugural function & Keynote Address-I	
Speaker: **Dr. Nageswara Rao Posinasetti** Professor University of Northen Iowa, USA Topic: **Introduction to Circular Economy** Host: **Ms. Neha Sharma** Asst. Professor, IPSCTM, Gwalior, IN	9:00 a.m. - 10:20 a.m.
Technical Session-I (Materials)	
Session Chairs 1. **Dr. Rahul Singh Sikarwar,** Associate Professor, VIT Vellore, IN	10:30 a.m. - 1:00 p.m.
2. **Dr. Suwarna Torgal,** Assistant Professor, IET,Devi Ahilya University,Indore, IN 2.**Dr. R. Prasad,** Asst. Professor, Hindustan College of Science and Technology, Mathura, IN	012006, 8, 10, 17, 24, 27, 31, 39, 48, 54, 63,
Technical Session-II (Mechatronics)	
Session Chairs 1. **Dr. Elammaran Jayamani,** Discipline Leader, Swinburne University of Technology, Malaysia 2**. Dr. Karunendra Verma,** Associate Professor, RAMA University, Kanpur, IN	10:30 a.m. - 1:00 p.m.
3. **Dr. Ishwar Prasad Sahu,** Associate Professor, IGNT University, Amarkantak, IN	012007, 11, 19, 32, 38, 43, 52, 53, 59, 72, 73, 74
Keynote Address-2	
Speaker: **Dr. V. K. Jain** Professor (Retired) Indian Institute of Technology Kanpur, IN Topic: **Micromachining: An Overview** Host: **Dr. Ashish Khaira,** Asst. Professor, Samrat Ashok Technological Institue, Vidisha, IN	2:00 pm - 3:00 pm
Technical Session-III (Mechanics & Design)	
Session Chair 1.**Dr. V.K. Dwivedi,** Professor (T&P), Madan Mohan Malviya University of Technology, Gorakhpur, IN	3:00 pm - 4:15 pm
2. **Dr. Avadesh K Sharma,** Associate Professor, Rajkiya Eng College, Mainpuri, IN 3. **Dr. Jyoti Vimal,** Asst. Professor, MITS, Gwalior, IN	012001, 3, 4, 77

Technical Session-IV (Manufacturing)		
	Session Chair 1. **Dr. R.K. Shukla,** Professor & Head, ABES Engineering College, Ghaziabad, IN 2. **Dr. Vijay Gadakh,** Associate Professor, Amrutvahani COE, Sangamner, IN	3:00 pm - 4:15 pm
	3. **Dr. Sanjay Mishra,** Associate Professor, MMM University of Technology, Gorakhpur, IN	012002, 15, 16, 21, 26

Keynote Address-3		
Speaker:	**Dr. Rohan Shirwaiker** Associate Professor, N C State University, USA Associate Director, Functional Tissue Engineering Program, Comparative Medicine Institute (CMI), USA	4:30 pm - 5:30 pm
Topic:	**Manufacturing of Tissues and Organs**	
Host:	**Dr. Madhavi Singh,** Penn State College of Medicine, USA	

March 07, 2021 (Day 2)	
Programme	**Time**

Keynote Address-4		
Speaker:	**Dr. Raghu Echempati** Professor, Kettering University, USA	
Topic:	**Study of Light Weight Materials and Their Applications** **Ms. Pragya Sharma**	9:00 a.m. - 10:00 a.m.
Host	Associate, OrangeBusiness Services, IN	

Technical Session-V (Mechanics & Design)		
	Session Chairs 1. **Dr. S.K. Panigrahi,** Associate Professor, VSSUT, Burla, IN 2. **Dr. Manoj Narwariya,** Associate Professor, IPS CTM, Gwalior, IN	10:15 a.m. - 1:00 p.m.
		012005, 14, 25, 35, 42, 51, 55, 57, 58

Technical Session-VI (Mechanics & Design)		
	Session Chairs 1. **Dr. Soon KokHeng,** Sr. Faculty Swinburne University of Technology, Malaysia 2. **Dr. Santosh Rane**, Dean, Sardar Patel COE, Mumbai, IN	10:15 a.m. - 1:00 p.m.
	3. **Dr. Ravi Mandawa,** Asst. Professor, Maulana Azad National Institute of Technology, Bhopal, IN	012029, 40, 44, 50, 66, 70

Keynote Address-5		
Speaker:	**Dr. Anjali Awasthi** Professor & Concordia University Research Chair (Tier–II) Concordia University, Montreal, CANADA	
Topic:	**Industry 4.0 and Digital Supply Chain Management**	2:00 pm - 3:00 pm
Host:	**Ms. Pragya Sharma** Associate, Orange Business Services, IN	

Technical Session-VII (Materials)		
	Session Chair 1. **Dr. Anil Yadav,** Professor, LNCT, Bhopal, IN 2. **Dr. Ruby Chakraborty,** Scientist	3:00 pm - 5:30 pm
	HOYA Optical Corp. & Entrepreneur at Biena Tec, USA 3. **Dr. Nitesh Dixit,** Associate Professor, Ram Manohar Lohiya University, Ayodhya, IN	012013, 18, 22, 33, 37, 47, 64, 65, 68, 71, 76

Technical Session-VIII (Manufacturing)		
	Session Chair 1. **Dr. Akshay Dwivedi,** Associate Professor Indian Institute of Technology, Roorkee, IN 2. **Dr. R.K. Porwal,** Associate Professor	3:00 pm - 5:30 pm
	Shri Ramswaroop Memorial University, Barabanki, IN 3. **Dr. Yaswant Modi** Associate Professor, Jaypee, Guna, IN	012012, 28, 34, 49, 56, 60, 61, 62, 67, 69

Technical Session-IX (Material & Mechanics) &Valedictory		
	Session Chairs 1. **Dr. S.K. Panigrahi,** Associate Professor, VSSUT, Burla, IN	6:00 pm - 8:00 pm
	2. **Dr. Premanand S Chauhan,** Professor & Principal, IPS College of Technology & Management, Gwalior, IN	012009, 20, 23, 30, 36, 41, 45, 46, 75

Program Schedule
March 06, 2021

Session: I   (March 06, 2021)

09:15 am- 10:15 am	Keynote Address 1
Topic of the Keynote	**Introduction to Circular Economy**
Keynote Speaker	**Dr. Nageswara Rao Posinasetti** **Professor** University of Northern Iowa, Cedar Falls, USA

Biography of Speaker: He is currently working as an Professor in the Department of Technology, University of Northern Iowa, Cedar Falls, USA. His active areas of teaching and research are Manufacturing Engineering and Design Engineering. He has received the "Distinguished Scholar" award from University of Northern Iowa for the year 2017-2018. He has authored a number of textbooks on Manufacturing Technology, CAD/CAM and Metal Casting, published by McGraw Hill India and American Foundry Society. He has wide interaction with the industry through the process of consultancy work and conducting continuing education programs on various aspects related to modern manufacturing. He has also published over 260 research papers in international conferences and journals. He is on the editorial boards of International Journal of Precision Technology, International Journal of Mechanical Engineering, Efficient Manufacturing, International Journal on Global Research in Science and Technology, and West Indian Journal of Engineering.

Abstract: Humans have been consuming resources taken from Mother Earth at an unprecedented rate. The unregulated and excessive consumption of natural resources combined with the ever increasing use of fossil fuels for energy generation is not sustainable for healthy planet. As the window of opportunity available for correcting this perilous journey taken by the mankind towards environment is shrinking every day. As a result, Sustainability has become a very important issue in the world today and all the countries are trying their best to regulate the growth in a sustainable way. Natural progression from sustainability to circular economy is logical and is the most important part in the world economy today. It is therefore necessary to establish methods of circular economy at the earliest possible time in all walks of life to improve the environment for all on this earth.

The circular economy is a concept in which growth and prosperity are decoupled from natural resource consumption and ecosystem degradation. By refraining from throwing away used products, components and materials, instead re-routing them into the right value chains, it is possible to create a society with a healthy economy, inspired on and in balance with nature.

It is necessary to understand the various elements that form the circular economy both from the bio sphere and technical sphere. As manufacturing engineers it is important to concentrate on the technical sphere to understand the reuse, remanufacture and recycle to reduce the material consumption to the extent possible. It is, essentially, an ecological economy that follows the principles of *"reducing resource use, reusing, and recycling"*.

The various paradigms to achieve circular economy need to be examined by the practitioners as well as government. This paper presents different aspects of circular economy and methods that could be utilized for achieving the highest benefit possible. It provides a broad idea of circular economy with the details of tools and methodologies that could be applied in the manufacturing sector. The tools such as LCA are to be applied to the various products and processes that are being used today so that they can be utilized to achieve circularity along with the various R's similar to the 3R's. The aim should be to create a system that allows for the long life, optimal reuse, refurbishment, remanufacturing and recycling of products and materials that would lead to circularity.

Session: II (March 06, 2021)

02:00 pm- 03:00 pm	**Keynote Address 2**
Topic of the Keynote	**Micromachining: An Overview**
Keynote Speaker	**Dr. Vijay Kumar Jain** **Professor (Retd)** Indian Institute of Technology Kanpur, India

Biography of Speaker: He did his B.Tech. from M.A.C.T. Bhopal (Vikram University, Ujjain), and M. Tech. and Ph.D. from University of Roorkee (now, I.I.T. Roorkee). He has about 44 years of teaching and research experience. He has served as a Visiting Professor at University of California at Berkeley (USA) and University of Nebraska at Lincoln (USA). He retired as a Professor from Indian Institute of Technology Kanpur after serving for thirty three years. Dr. Jain has won three gold medals, two silver medals and one best paper award as recognition to his research work. He is Editor-in-chief of three International Journals and Associate Editor of Int J. Engineering Manufacture and J. Machining Science and Technology. In recognition to the research work of Dr. Jain, he has been opted as a member of the editorial board of more than ten International Journals. He has also worked as a GUEST-EDITOR for more than ten special issues on TQM, CAPP, Advanced Machining processes, micromanufacturing, and micro fabrication. He has more than 300 publications to his credit. He has written and edited eight books. He has guided fifteen Ph.D. students and around one hundred M. Tech. / M. E. students. Dr. Jain has various research areas of interest, viz. advanced machining techniques (ECM, EDM, AFM, MAF, MRAF, and others), machining of advanced engineering materials, shear strain acceleration phenomenon in metal cutting, computer aided manufacturing, and CAPP.
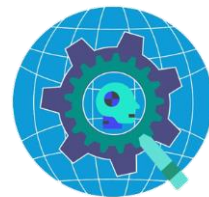
Session: II (March 06, 2021)

04:30 pm- 05:30 pm	**Keynote Address 3**
Topic of the Keynote	**Manufacturing of Tissues and Organs**
Keynote Speaker	**Dr. Rohan Shirwaiker** **Associate Professor**, North Carolina State University, US **Associate Director**, Functional Tissue Engineering Program, Comparative Medicine Institute, CMI, USA

Biography of Speaker: He is an Associate Professor of Industrial & Systems Engineering and Biomedical Engineering, and Associate Director of the Comparative Medicine Institute at North Carolina State University located in Raleigh, US. His research focuses on the development and optimization of bio manufacturing processes and quality monitoring techniques to create and evaluate tissue and organ substitutes for a variety of medical applications. Shirwaiker has coauthored over 100journal and conference publication shas received several distinctions including the US National Science Foundation's CAREER Award, SME Outstanding Young Manufacturing Engineer Award, and IISE Manufacturing & Design Outstanding Young Investigator Award. He currently serves on different boards and committees for professional organizations including ASME, ASTM, IISE and SME.

Abstract: Medical implants play an important role in improving the quality of life of patients affected by injuries and diseases. Whereas implants are traditionally made of bio inert metals and polymers, recent advances in computer aided engineering and bio manufacturing enable us to design and fabricate patient-specific biological substitutes that can mimic the characteristics of native tissues and organs using living cells and multi-functional biomaterials. This talk will provide an overview of tissue engineering and bio manufacturing technologies, with examples of applications in orthopaedics. Challenges and opportunities in the scale-up and translation of these technologies from research labs to clinics will also be discussed.

Program Schedule
March 07, 2021

Session: I (March 07, 2021)

09:00 am- 10:00am	**Keynote Address 4**
Topic of the Keynote	**Study of Lightweight Materials and their Applications**
Keynote Speaker	Dr. Raghu Echempati **Professor** Department of Mechanical Engineering Kettering University, Flint, MI, USA

Biography of Speaker: He is a Professor in the Department of Mechanical Engineering, Kettering University. His research areas included Kinematics, Dynamics and Vibrations of Machinery, Mechanical Engineering Design, Computer Aided Engineering (Solid Modeling, Assembly and Finite Element Analysis), and Metal Forming Simulation. Prior to this appointment, he worked with I.I.T. (Delhi), The Ohio State University, Washington State University, Michigan Technological University, and University of Mississippi. Dr. Echempati is involved in several applied research and consulting projects, including a research study under the Bosch-Ketteringprofessorship. He also worked at General Motors as a Faculty Intern in the Die Design and Forming Analysis division to understand math-modeling for metal forming simulation. Dr. Echempati delivered several invited lectures and conducted workshops on CAE in Australia, Brazil, India and S. Korea. Dr. Echempati is a member of the American Society of Mechanical Engineering (ASME), Society of Automotive Engineers (SAE), and the American Society of Engineering Education (ASEE). He was named an ASME Fellow, which is the highest recognition that can be attained by any ASME member. He has also received the McFarland award from SAE for his sustained contributions to SAE.

Abstract: Weight reduction or lightweighting in mobility industries has been an important factor in order to meet the functional requirements and other regulations of a particular country. Mass reduction versus vehicle size, increased strength, safety and stiffness have been challenging to balance in real life due to other competing functional performance particularly for automotive applications such as crash performance, aesthetics, corrosion, cost, reliability and joining methodologies to mention a few. Steel and its alloys have been, and still will be, the dominant material used in mobility industries. However, use of multi-material technologies with aluminium, magnesium, plastics and nanocomposites, is drawing the attention of many automotive and aerospace industrial sectors.

In this keynote talk, a few of the above-mentioned issues and how they can be addressed using lightweighting materials and their technologies will be broadly covered. Some details about using different materials for the body in white (BIW) components and the role of nanocomposite materials will be discussed. Case studies developed by industry experts will be discussed.

02:00 pm- 03:30pm	**Keynote Address 5**
Topic of the Keynote	**Industry 4.0 and Digital Supply Chain Management**
Keynote Speaker	Dr. Anjali Awasthi **Professor & Concordia University Research Chair (Tier–II)** Concordia University, Montreal, CANADA

Biography of Speaker: She is a Full Professor and Concordia University Research Chair (Tier-II) in Connected Sustainable Mobility Systems at the Concordia Institute for Information Systems Engineering, Concordia University in Montreal, Canada. Her areas of research are modeling and simulation, data mining, Information Technology and decision making, sustainable logistics planning, quality assurance in supply chain management and sustainable supply chain management. She is currently serving as the Education Chair for CORS (Canadian Operations Research Society), is an associate of LSRC (Loyola Sustainability Research Center), and a regular member of CIRRELT (Centre Interuniversitaire de Recherchesur les Reseauxd'Entreprise, la Logistique et le Transport). She is also the recipient of Eldon Gunn service award (CORS 2018, Halifax) and IEOM Special Recognition Award (4th North American Conference on Industrial Engineering and Operations Management, Toronto, 2019).

Abstract: Industry 4.0 is the digitization of a company's physical assets and the company's integration into digital ecosystems with its value chain partners, from suppliers to customers. It uses smart technology and the use of real-time data to increase flexibility, customization, efficiency and productivity, and to reduce time, costs and innovation cycles. Due to disruptive technologies, the digitization of processes, and an explosive growth in data, Industry 4.0 will have a major impact on the way products are designed, manufactured, assembled, shipped and repaired, and on the people that have to adapt to these changes. Industry 4.0 focuses on nine technologies: autonomous robots, system integration, the internet of things (IoT), simulation, additive manufacturing, cloud computing, augmented reality, big data, and cybersecurity. Through these technologies, new supply chain paradigms can be achieved, and production and related logistics processes will change. The proposed talk will focus on digital supply chains, with the objective of developing seamless, end-to-end, performance tracability across multiple tiers by leveraging the advantage of Industry 4.0 technologies. Four key decisions will be addressed namely inventory management, quality management, product lifecycle management, and cross-disciplinary workforce planning. Practical examples will be provided.

Paper ID	012001
Title	Design and development of modified cold compaction die for fabrication of nickel-titanium composite
Authors	Rajeev Singh, Avadesh K Sharma and Ajay K Sharma

Abstract: Generally, nickel-titanium (NiTi) composites are prepared by powder metallurgy process in which the design and shape of compaction die can significantly affect the features of the final products. The formation of circumferential cracks and higher porosity are the major issues of this process. Therefore, this work is an effort to design and fabricate a modified cold compaction die by incorporate one additional part named as liner that prepared the NiTi composite without circumferential cracks. The work includes design consideration, drawing and processes involved in the fabrication of die. The die design was analyzed by SOLIDWORKS software in a simulated environment, and further tested experimentally by preparing the composite sample at 140 kN compaction load using universal testing machine. The results showed that a crack-free dense NiTi composite was successfully fabricated by this modified die. The densification, compressive strength and Rockwell hardness of NiTi composite fabricated using this die were achieved upto 86.7 %, 108.29 MPa and 64.2 HRC.

Keywords: Composite, cold compaction, powder metallurgy, density, mechanical properties.

Paper ID	012002
Title	Automated paste preparation machine
Authors	Mohd Almasood, Samriddhi Singh, Yogendra Singh Rajpoot and Deepak kumar

Abstract: Ayurveda industry is one of the golden industries in ancient India which over the period had declined is witnessing a new surge up; this paper describes an automated approach for developing automated paste preparation machines for the health sector and Ayurveda industry. Automated paste preparation machine models are prepared on the basis of requirements and then tested and finally go into the manufacturing stage. This paper basically describes the methodology of preparation of machine models. In these automated paste preparation machine models, we use cam follower mechanism for the timed opening of valves to ensure the correct amount of ingredients to be instilled into the bowl. Control of opening and closing of valves through cam follower mechanism is achieved by the programming of gear motor with the help of Arduino Uno. An experimental case study is presented to show advantages, which include a verified reduction in model development time and improved modeling consistency and quality

Keywords: Arduino Uno, cam follower, L293D motor driver, LCD module.

Paper ID	012003
Title	Structural health monitoring of splice joint in a steel beam
Authors	Aastha and R.R. Singh

Abstract: Now-a-days steel sections are extensively used in various constructions because of its lesser erection time and higher reliability. These members are connected either by welding or bolts. As the time goes on the structure degrades due to various reasons. In our study degradation of joints with bolted connections is presented. In reality, joints are damaged frequently when compared to the other parts of the structure. As bridges are generally of long spans splicing is done to ensure the continuity of the spans and this splicing is done with the help of welding or bolts. Loosening of bolts is the most common damage which occurs in bolts and this makes the joint act like a semi-rigid joint. We have considered a bridge model consisting of two beams connected by splicing with the help of bolts and this entire modelling is done in ABAQUS 6.13. Our intention to study the behaviour of the joint in both damaged and undamaged case. Loosening of bolts is considered as damage and deflection of the joint is considered as the extent of damage. We have performed static analysis on the model. Theoretical validation is also done by developing elemental stiffness matrix with semi-rigid connections using fixity factors.
Keywords: Splice joint, Bolts, ABAQUS 6.13, Static analysis, Stiffness matrix.

Paper ID	012004
Title	Feature curve extraction from data points
Authors	Sushant Gautam and Vandana Agrawal

Abstract: In the present work, study is done for the extraction of feature curves from data points lying on the surface of object or model. Here, the reconstruction of feature curves is proposed by intersection of plane pairs. These plane pairs approximate the adjacent regions of the feature. Feature of the object may be its edges, corners, holes, sudden jerks, slits etc. Points cloud is generated from the snapshots of the object taken from various viewing angles. Clustering work is extended from K-means clustering to combined K-means and Normal (attribute) approach based clustering as it utilizes the benefits of both K-means and attribute based method and segmented the data points so that a cluster is represented with similar normal vector. Planes are fitted to all clusters based on Least Square Plane Fitting (LSPF) method and line segments from their intersection are identified, highlighted and collected as feature lines i.e. edges and corners based on developed algorithm.
Keywords: Points cloud, Sharp features, Feature curve, Developable surface, Clustering.

Paper ID	012005
Title	Seismic soil structure interaction of reinforced concrete frame building supported on foundations
Authors	I Bhuvana Rekha, Lingeshwaran N, Sunny Agarwal and Sateesh Madavarapu

Abstract: Soil Structure Interaction (SSI) determines the response of structures during seismic activity. An engineering review committee deals only with the study of soil structure interaction as compared to free motion, gives an appreciable impact on the basement motion. This article investigates the influence of soil structure interaction on RC frame building with seismic excitations. By taking different cases like 5, 10, 15, 20 storey of varying soil types are type I, type II and type III, different foundation types are isolated, combined, mat, pile. The entire foundation-soil-structure system is modelled and analyzed in a finite element based SAP2000 Software, to study the stress on soil and framed structure in the presence of SSI. Finally, a comparative study between with and without SSI to reinforced concrete framed structure is done. The study shows that SSI effects are higher than regular approach if we include the SSI effects in our analysis and design of structure to get a safety design.
Keywords: Dynamic analysis, Fixed base, Soil structure interaction, SAP 2000.

Paper ID	012006
Title	A review paper on materials used for manufacturing of alloy wheels
Authors	A Naim, R Kumar and S Bhatia

Abstract: In this review paper we have done a detailed study on the different types of material that we can use for the manufacturing of alloy wheels in order to meet the need of the market. During this project we studied the fatigue analysis of aluminum, magnesium, and titanium alloy wheels on the basis of their deformation under load, maximum shear stress of materials, and equivalent stress of the materials. Also we studied the different methods of production of alloy wheels.
Keywords: Alloy Wheels, Fatigue Analysis, Production of Alloy Wheels, Stress Analysis.

Paper ID	012007
Title	Development of a bi- directional multi- input multi- output predictive model for the fused deposition modelling process using co-active adaptive neuro-fuzzy inference system
Authors	Ananda Rabi Dhar, Dhrubajyoti Gupta and Shibendu Shekhar Roy

Abstract: In the automated manufacturing industries, modelling and prediction of the process parameters of additive manufacturing plays an important role. This paper proposes a computationally intelligent method using coactive-adaptive neuro-fuzzy inference system to establish relationships between the process parameters and the responses, in both forward and backward directions, for the fused deposition modelling process. Experimental data have been statistically analyzed and regression equations have been generated to produce large training samples. The model has been built using six input process parameters, viz. layer thickness, air distance, build inclination, raster angle, road width and number of contours each with non-linear Gaussian membership function distributions, and three responses, which are: build time, feedstock material consumption and dynamic flexural modulus, each with linear membership function distributions for the forward-directed mapping. Similarly, three inputs and six outputs from the same training data set have been used to formulate the backward-directed inference model. The parametric study for the used back propagation algorithm has been conducted and validation has been accomplished with the optimal settings using actual experimental data.

Keywords: Additive manufacturing, fused deposition modelling, C-ANFIS, forward mapping, backward mapping.

Paper ID	012008
Title	Investigation of electric properties of flax reinforced polypropylene/strontium titanate composite for multilayer dielectric applications
Authors	Hari Prashanth PVS, Elammaran Jayamani and Kok Heng Soon

Abstract: Electrical properties such as dielectric constant, dissipation factor, capacitance and conductivity are some of the properties that are required to be investigated when a novel composite is fabricated. The aim of this research is to achieve a low dielectric constant (less than 4.2), lowered dissipation factor, lowered conductivity by fabricating a novel natural fiber reinforced polymer composite and investigating their properties. In this research, polypropylene with 14 wt% of strontium titanate, 8 wt% of treated flax fibers was fabricated using compression molding and tested for their dielectric and conductive properties. The capacitance and dielectric constant was found be significantly higher (43 percent) than that of pure PP or PP-flax and a gradual decrease was observed as the frequency was increased. The dissipation factor and conductivity was found to be higher for pure PP however, the full composite showed moderate conductivity showing that delays in charge losses could occur making it an ideal composite for dielectric multilayer applications.
Keywords: Natural fiber reinforced polymer composites, flax fibers, ceramic, dielectric constant, conductivity.

Paper ID	012009
Title	Comparison of a decade's data between LST and NDVI data for agricultural drought analysis in Rayalaseema region, AP, India
Authors	Gayathry Damarla and Naga Chaitanya Kavuri

Abstract: Drought is an extreme weather condition that disturbs agricultural production by raising the temperatures and altering precipitation patterns. As agriculture in India heavily depends on monsoon, any changes in these patterns will severely affects its agricultural economy. Rayalaseema is one of such regions which was hit by sever draught conditions in past few decades. The region depends on the traditional agricultural economy; thus, not only production but also the life of the common man is influenced by the impact of drought on agriculture. The purpose of this study is to investigate vegetation stress in the Rayalaseema region with the help of normalised difference vegetation index (NDVI) values and land surface temperature (LST) for the years 2011 and 2019. To measure both NDVI and LST, satellite data is used. A clear interdependency between LST and NDVI was observed and it was found to be a negative correlation between them. The correlation values for 2011 and 2019 between LST and NDVI were found to be -0.44577, -0.80447 respectively. The influence of rain fall data was also discussed in the study to explain the increase in NDVI values during the last quarter of 2019.
Keywords: LST, NDVI, Agricultural Drought, Rayalaseema.

Paper ID	012010
Title	Discussion and analysis of different in-situ methods for fabrication of Aluminium-TiB2 composite.
Authors	Ruchi Pathak, Pritha Sanbigrahi and Rajeev Singh

Abstract: In this study, different in-situ phase development techniques in the aluminium matrix are analyzed based on results obtained by using these methods. Microstructural and mechanical characteristics of aluminium-matrix composites reinforced by in situ titanium diboride (TiB2) have been analyzed in this paper. During the study, it is found that using in-situ methods for phase development in aluminium based composites is more appropriate than other ex-situ methods. The interfaces between titanium diboride (TiB2) reinforcement and aluminium (Al) matrix are clean, and enhanced mechanical characteristics can be achieved.
Keywords: In-situ phase, TiB2 Phase, Aluminum matrix.

Paper ID	012011
Title	Study and development of searching casualty and detecting fire by rescue robot
Authors	Sandeep Yadav, Rituraj Raghuvanshi, Avi Bhadviya, Rahul Sonare, Satyam Paliwal and Vikas Kashiv

Abstract: The project titled study and development of searching casualty and detection of fire by rescue robot is associated with new equipment to complete the task and to respond in hazards situation. Search and rescue robots are developed for a certain purpose that humans can't perform. Our objective is to design, construct, and develop a robot to use in emergencies that will be able to perform the search and rescue operation. Collapsed buildings are the most unstable place toper form search and rescue mission by human where the weight and size limits the rescuer movements. The robot is designed to locate injured victims and life triangle in debris, to create a map of the disaster area and to collect the necessary information needed by digging and support robots in order to the database center.
Keywords: Rescue, robot, victims, emergencies, rescuer.

Paper ID	012012
Title	Optimization and fabrication of pure poly lactic acid (PLA) using hot press compression moulding
Authors	M J Kamran, E Jayamani, K H Soon and Y C Wong

Abstract: Biodegradable poly lactic acid (PLA) samples were optimized and fabricated for flexural, tensile, hardness, and dielectric testing, according to the American Society for Testing Materials (ASTM). In order to achieve the highest value of tensile strength, flexural strength, and hardness, hot pressing compression molding was utilized to optimize PLA. Furthermore, not enough research was available regarding the preparation of PLA samples or composites using hot press compression molding. However, different magnitudes such as processing temperature, processing pressure, compression time, and cooling/resting time played huge roles. Each of these magnitudes was constantly changed in order to optimize PLA. Optimization was achieved after several runs, and samples were produced using the optimized method. These samples were then tested for tensile strength, which was 2.2 Mpa, flexural strength, 7.6 Mpa, Rockwell hardness C scale, 59, and dielectric constant/loss. The highest dielectric constant value achieved was 1.07810 at 1kHz frequency, and the highest amount of dielectric loss was 0.14910 at 2MHz frequency.
Keywords: Optimization, Fabrication, Hot press, Compression molding, Poly Lactic acid.

Paper ID	012013
Title	Prediction of performance parameters of a four stroke diesel engine experimented with blends of vegetable oil biodiesel
Authors	Deepali Bharti, Pushpdant Jain, Bhupendra Koshti and Rajesh Nag

Abstract: Fossil fuel consumption is increasing in a massive amount due to its applications in various sectors. Moreover, use of such fuels creating harmful fumes and gases, which in turn creating an impact on the environment. To reduce the impact on the environment, researchers are continuously trying to research and propose various alternative fuels. In the present work, the Biodiesel was prepared from waste vegetable oil and used as a fuel in combustion ignition engine. The performance a four-stroke, single-cylinder, water-cooled, combustion ignition diesel Engine connected to a dynamometer checked with prepared Biodiesel. A mixture of waste vegetable oil with pure diesel is mixed with different proportions of blends such as 10%, 20% and 30% to conduct the experiments. Various experiments with different conditions were considered to identify the effect of prepared Biodiesel blends. The experiment results showed that among all blends of Biodiesel, the 20% blend of Biodiesel had given the best results for maximum considered parameters. Such as at highest load of 15 kg, the Brake thermal efficiency obtained maximum as 22.45%, 21.8%, 19.8 and 16.6% for 20%, 10%, pure diesel and 30% blend of Biodiesel. It can be inferred from the experimental investigation suggests that the blended Biodiesel may be used as an alternative fuel in a single-cylinder four-stroke diesel engine without any modification in the existing engine. The obtained experimental results may be further utilised to perform the various analysis to enhance engine working conditions.

Keywords: C. I. engine, Internal Combustion Engine, Waste Vegetable Oil, Performance Parameter, Biodiesel.

Paper ID	012014
Title	Experimental and analytical investigation on high performance concrete-filled steel tube stub columns under axial loading
Authors	Harini B, Lingeshwaran N and Siva kishore I

Abstract: There has been an enormous improvement in the construction field in recent few decades among these; construction and material innovation are quite prominent. Concrete - steel composite part is one rising advances as perhaps the fastest technique for development. CFST stands for composite column, which consists of a steel tube filled with concrete. Experimental and theoretical work on high-performance concrete-filled steel tube stub columns under axial compression is explored in this paper. The parameters included in this study are thickness, the diameter of stainless steel tubes, mix design of high performance concrete & ultimate load-carrying capacity. Six composite stub columns are cast and tested. The design formulas of CFST under axial loading are predicted using EUROCODE 4, ACI 318-95, AS 3600 & AS 4100. The finite element modeling of this composite column is done by using ABAQUS software.

Keywords: Axial load, composite stub column, confinement of concrete, conventional concrete, high performance concrete.

Paper ID	012015
Title	A review on multi-nozzle electro hydrodynamic inkjet printing system for MEMS applications
Authors	Adrija Biswas and Shibendu Shekhar Roy

Abstract: New microproducts require to utilize the diversity of materials and have complicated three dimensional (3D) microstructures with high aspect ratios. This ability to fabricate geometrically complicated 3D microstructures provides some additional profits to the additive manufacturing systems over traditional methods. Among the enormous variety of micro-products, the major kinds are micro electromechanical systems (MEMS), micro-opto-electro-mechanical systems (MOEMS), and microelectronic products and micro-optical electronics systems (MOES) depending on the mixtures of product usefulness and operation fundamentals. Electro hydrodynamic (EHD)-inkjet printing is a novel high resolution inkjet printing technology with the advantages of being a maskless, non-contact, direct-write and additive process. Its printing resolution exceeds by about two orders of magnitude compared to the conventional inkjet printing systems. It is used in the field of micro/nano manufacturing for patterning of large class of materials on a variety of substrates with the options to use either Drop-On-Demand (D-O-D) or continuous mode. It is considered to be a promising alternative to piezoelectric and thermal based inkjet printing techniques because of its unique feature of generating very small jet or droplets as compared to the nozzle orifice. Various advantages in fine patterning are offered by EHD inkjet printing processes, but the low production speed of EHD inkjet printing is a severe drawback that has hampered its possible widespread applications in electronic industry. To overcome this limitation, the direct printing of colloidal solutions with the help of multi-nozzle EHD inkjet printing process is used. This review gives a brief account of multi-nozzle electro hydrodynamic inkjet printing of colloidal solutions for its application in MEMS

Keywords: Electrohydrodynamic inkjet, MEMS, Multi-nozzle.

Paper ID	012016
Title	Additive manufacturing of multi-functional biomaterials for bioimplants: a review
Authors	Shubhadip Paul, AnanyaNath and Shibendu Shekhar Roy

Abstract: Additive manufacturing (AM) has been emerged recently as a promising technique to manufacture biomaterials for bioimplants creating a high impact in the field of medical science and research. AM technologies facilitates fabrication of the micro- as well as macro architectural framework of orthopaedic bioimplants both internally and externally with higher precision and flexibility. The topological as well as geometrical porous nature of metallic biomaterials by means of controlled AM processes for fabrication of bioimplants can be adapted with high precision, leading to the upgradation of mechanical properties for bone-mimicking with improved biodegradation features. The increasing demand for the application of multifunctional biomaterials to manufacture metallic bioimplants as substitute of bone confronts the current additive manufacturing technologies. In this paper, recent technological advancement in the manufacturing of Ti-, Mg- and Fe-based biomaterials utilizing multi-material AM technologies is being reviewed for identifying the knowledge gaps and come up with the directions of further researches leading to the progress of multi-material based additive manufacturing technologies to fabricate metallic bioimplants by virtue of multi-functional biomaterials.

Keywords: Additive Manufacturing, Bioimplants, Multi-functional Biomaterials.

Paper ID	012017
Title	Effect of parametric study on microstructure during FSW process
Authors	Kupsingh Kandir, Pragyan Paramita Mohanty and Manish Kumar Swain

Abstract: The work focuses on the improvement of strength-weldability combination in Friction Stir Welding (FSW) joint of 7075 and 6061 Aluminium Alloys. Although Al-6061 and Al-7075 both are heat treatable but they are having somewhat different mechanical properties. The 7075-T6 has more tensile strength and hardness than that of 6061-T6.The lower hardness of 6061-T6 allow it to weld easily whereas 7075 prone to cracking during welding. Owing with the result that FSW could play an important role to improve the mechanical properties as well as the weldability, microstructure of cross section as well as the mechanical properties of welded section was characterized. The welds were produced by using three rotational speed and three feed. It was revealed that the tensile strength of the joint (153.13 MPa) became very less in comparison to the base metal and it has been decreased again when the rotational speed decreases from 700rpm and 15mm/sec to 2000rpm and 25mm/min.The findings such as tensile strength as well as the fracture revealed that mechanical properties and the microstructure of welding are not desirable for any structural application.

Keywords: Friction Stir Welding, Microstructure, Crack, Material Properties, rotational speed, feed.

Paper ID	012018
Title	Review on advance tubular receivers for central solar tower system
Authors	Kaustubh Kulkarni , Sanjay Havaldar and Nabharun Bhattacharya

Abstract: This review focused on central tubular receiver modelling to obtain concentrated solar energy. Required specifications involved with efficient low cost receiver with suitable material which able to absorb concentrated solar radiations. This type of advance receivers shows excellent performance in the commercial and domestic applications. Review shows compiles literature engaged in mechanical and thermal modelling of receiver. Also highlighted on various geometries, tube sizes and various heat transfer fluids and their effect on overall performance of receiver. Recently authors concentrated on CFD simulations of different kind of receiver and put forth advanced design which offers superior flexibility and accuracy also explains stresses generated in the tube of receiver. The selection of stress theory is impacting on the mechanical life of the receiver with different approaches presented. Extensive technical analysis is investigated on different receivers for internal and external tubular geometry. Effect of heat transfer for different geometry is also observed. In this paper different aspects discussed thoroughly like receiver design, Numerical simulation, outdoor and indoor testing facilities, thermal efficiency and desired outlet temperature, benefits, future challenges, and research needs.
Keywords: Concentrating solar power, Tubular receiver, Cavity, HTF, Particle receiver.

Paper ID	012019
Title	Global system for mobile communication (GSM) monitoring in industries using arduinouno
Authors	Sandeep Yadav, Rituraj Raghuvanshi, Gaurav Soni, Lokesh Bangali and Shishank Singh Bundela

Abstract: The scope of our project is to notify the owner of the premises, the fire department and authority immediately after the sensors detect any fire or gas leakage in the property. The notification is sent through Short Message Services (SMS). The problem solved by our system is to have a quick automated warning alert to the fire department, the owner of the premises and authorized person to reduce the losses. In case of fire and gases release, a buzzer will get activated and a fast-automated alert notification will be sent via SMS. The path to the development of the automation system at home and in industry is almost the same these days. In this paper, we have tried to raise these standards by incorporating new design techniques and building a low-cost home with automated security systems. Everyone wants to be safe as much as possible. The easy connection simple to understand will help every user to use the wireless system for security using the sensors at industries.
Keywords: Gas, smoke, temperature detector.

Paper ID	012020
Title	Experimental study on mechanical properties of polypropylene fiber reinforced concrete with silica fume
Authors	Aravind Sai Yandrapati and M. Anil Kumar

Abstract: In this research, the mechanical properties of polypropylene and silica fume are examined with the 0.40% water-cement ratio of M40 grade concrete. The synthetic polypropylene fibers of length 12mm short fibers. in this study, the polypropylene fibers are used up to 0.3% (0%, 0.1%, 0.2%, 0.3%). And the silica fume is being utilized as a substitute for cement with a 4% mass of cement in all the mix proportions. The addition of silica fume to the cementitious matrix strengthened fiber scattering, resulting in a substantial decrease in the absorbency of the polypropylene fiber reinforced concrete (PPFRC). Superplasticizer is also added to these concrete mixes to increase workability. The concrete samples are prepared and cured for 7, 14, 28 days. After completing the curing duration, samples were tested. After That finally, the mechanical properties, as comp. strength, split tensile, bending strength and mode of failure and ultimate load are determined and all proportions of the mix are compared to traditional concrete.
Keywords: Polypropylene, Silica fume, PPFRC, M40, Mechanical properties.

Paper ID	012021
Title	An overview to micro-wire-electrical discharge machining
Authors	Rajesh K Porwal, Vinod K, Premanand S Chauhan and Rajendra K Shukla

Abstract: Hard to cut metals are widely machined with the help of Wire EDM process which overcomes major challenges in the conventional machining processes. For generation of microfeatures and complex three dimensional structures Wire EDM is considered above other unconventional machining process like abrasive jet, laser, plasma and electron beam machining. Wire EDM provides better dimensional accuracy, machining rate and surface finish, with flexibility to alter process parameters. Importance and utilization of micro or nano parts in aerospace, medical, missiles & ballistics and automobile requires machining process like μ-WEDM to obtain desired features and intricate geometries. This study approaches and enlightens the work areas where micro level features have been generated using Wire EDM by different researchers, using diverse experimentation, modeling and optimization approaches for Wire-EDM. Finally, conclusion and future scope at the completion of the chapter binds up the present study
Keywords: Micro-WEDM, Surface roughness, MRR, Micro machining, Kerf.

Paper ID	012022
Title	Horizontal axis wind turbines passive flow control methods: a review
Authors	Sudhanshu S Manerikar, Sourabh R Damkale, Sanjay N Havaldar, Shubhanga V Kulkarni and Yash A Keskar

Abstract: In improving wind turbine torque and power output, the aerodynamic characteristics of wind turbines blades play an important role. Unleashing easy but efficient flow enhancement techniques over airfoil sections used in horizontal axis wind turbines (HAWT) has become essential in the increasing demand for this source of renewable energy. This paper investigates various passive flow control strategies that have great potential to boost the aerodynamics of blades of HAWT. The mechanisms and working principles, along with the findings from various experimental studies for passive flow control systems are included in this article. The review suggests simple, cost-effective ways of improving lift and controlling the airfoil stalling behaviors to obtain higher power efficiency for HAWT.
Keywords: Horizontal Axis Wind Turbine, Passive Flow Control Methods, Stalling Angle, HAWT.

Paper ID	012023
Title	Prediction of passenger flow for north central railway region through ANN
Authors	Anoop Pratap Singh, Ajay Tripathi, Ravi Kumar Dwivedi, Anurag Garg and Rajan Kumar

Abstract: A new method of prediction method is described in this paper. The passenger rate for the north central railway (NCR) region is estimated by using artificial neural networks (ANN). An ANN model is developed here that can logically estimate passenger flow rates. Which helps the decision makers to make the strategies according to the falling population. In this analysis data from the North Central Railway region from January 2009 to December 2015 have been taken, data such as passenger revenue, months and years, festival seasons and passenger numbers. When predicting passenger flows for the months of January and February 2016, an error of less than 2.9% is found. Therefore, it's concluded that an ANN prediction method is applied in passenger flow prediction in railways.
Keywords: Passenger flow prediction, Back Propagation (BP) Neural Network, Data Analysis.

Paper ID	012024
Title	Investigation on dynamic behaviour of shape memory alloy (SMA) wire embedded composite
Authors	Ranjit A. Patil, Santosh B Rane and Samir B Kumbhar

Abstract: Smart Material are responsive and intelligent materials. Shape memory alloy (SMA) are subset of a broad class of smart material. The functionalities arise from their underlying microstructural changes when subjected to external non-mechanical stimuli like temperature or magnetic field changes. The study of SMA uses and applications has been done because recently use of shape memory alloy used in the field of the automobile, robotics, medical, Aerospace, Biomedical domain etc. Shape memory alloy can be used for an actuator, sensor, stiffness changer, and damper. The extensive literature survey has been conducted to explore the potential and research scope in this project. This research will help industry to use SMA embedded composite for vibration isolation and damping

Keywords: Shape memory alloy, Composites, SMA damper.

Paper ID	012025
Title	Investigation of cold-formed steel open channel element under gravity loads
Authors	Ch Uday Kiran and I Siva Kishore

Abstract: The specimen study consists of short, thin-walled columns made of cold-formed steel with an open top-hat cross-section. The walls in the specimens analyzed are made up of thin sheet component. Profiles were analyzed to classify the critical forces and post-critical stability paths. The ends of the column profile are considered to be supported. The numerical investigation was undertaken using the finite element method. The research includes an investigation of the post-critical stage of the profile on the different gravity loads of different thicknesses, depending on the eigenvalues of the profiles. The numerical simulation of the profiles is done using the ABAQUS® software. Based on a comparison of the outcomes of the profiles, an optimal profile is recommended for further analysis.

Keywords: Gravity loads, critical forces, cold-formed steel, post-critical paths, eigenvalues, finite element method.

Paper ID	012026
Title	Artificial neural network (ANN) based prediction of process parameters in additive manufacturing
Authors	Hardik Sondagar, S S Bhadauria and V S Sharma

Abstract: In recent years, selective laser melting (SLM), a part of additive manufacturing (AM) is one of the most encouraging ones that permit fabricating metallic parts from metal powder with complex geometry. Diversities in these cycle boundaries become an imperative system to improve the nature of the outcome. Cycle boundaries, for example, laser power, scan speed, hatch spacing, layer height used as input parameters and have a significant impact on the mechanical property taken as an output parameter of the manufactured part. The Artificial Neural Network (ANN) model includes a multi-layer perceptron (MLP) learning algorithm named as Levenberg-Marquardt and tangent sigmoid function consider as preparing and testing functions respectively utilizing MATLAB toolkit. Ideal cycle boundaries are attained dependent on the mean square error function (MSE) and correlation coefficient ($R2$)

Keywords: Additive manufacturing, artificial neural network, MATLAB, ANOVA.

Paper ID	012027
Title	A critical review on the wear and corrosion of carbide free bainitic steel
Authors	Siddharth Sharma, Ajay Tripathi, Ravi Kumar Dwivedi, Rajan Kumar and Anupma Agarwal

Abstract: Different research on wear and corrosion of carbide free bainitic steel over the past two decades has enabled a better understanding and advanced applications of carbide free bainitic steel. Due to the advanced testing techniques, and equipment the detailed study of microstructure and nanostructured steels has been possible. The earlier years were focused on comparison of the bainitesteel with the quenched and tempered steel (QT) for identifying the wear tendencies and comparison between carbon free bainite and martensite for the corrosive behavior of the carbide free bainitic steel. Later the trend shifted towards the nanostructured analysis from microstructure analysis with the improvement in the instruments. Advancements like HT-CAT i.e., high temperature continuous abrasion tester have an important role to play, the mechanism of material removal rate studied. There has also been development in alloying the bainite to reduce the corrosion rate and give more strength. Current trends in the form of study of wear and corrosion of carbide free bainitic steel and future needs are discussed hereby

Keywords: carbide-freebainite steel; heat-treatment; rolling/sliding wear; friction; mechanical properties.

Paper ID	012028
Title	Influence and application of poka-yoke technique in automobile manufacturing system
Authors	Rajan Kumar, Ravi Kumar Dwivedi, Sudhir K Dubey and Anoop Pratap Singh

Abstract: Manufacturing defect are most important parameter to improve the quality of product for the all-manufacturing industries. In the manufacturing sector day by day new tool and new techniques are applying to improve the quality manufacturing at low cost. In this practical study discussed about the most important tool of lean manufacturing is poka-yoke (mistake proofing) technique. In all the manufacturing sector, a lot of small-small problem is affected the product quality and cost. In this paper the 70×90×10 oil seal mixing poka-yoke is solved for the improvement of quality of the product and save the manufacturing cost.
Keywords: Poka-Yoke, Lean Manufacturing, Oil seal, Automobile.

Paper ID	012029
Title	Morphological parameters of nanoparticles used in nano lubrication – A review
Authors	Anoop Pratap Singh, Ajay Tripathi, Matsyendra Nath Shukla and Amit Suhane

Abstract: Nanotechnology provides a lot of progress in all areas of engineering and technology. Similarly, in the field of lubrication, nano particles play vital role. It has been intensively evaluated in the last many years. Nano particles capable of improving the performance of lubricating oil. This review summarizes the morphological parameters of nanoparticles in the field of oil lubrication. Researchers studies various shapes, sizes and compositions of nanoparticles. This review is able to provide information about the morphological parameters of nanoparticles for better understanding of nano lubrication.
Keywords: Nanoparticles, Nanoparticles Morphology, Tribology, Nano Lubricants.

Paper ID	012030
Title	Three dimensional finite element analysis on the flexural behavior of composite beams under linear displacement
Authors	T Hemanth Kumar and G Sri Harsha

Abstract: This paper presents a three-dimensional finite element model for reinforced concrete beams to study their flexural behavior under linear displacement with different mesh sizes. The model was assessed in terms of failure modes and ultimate strength of composite beams with three different mesh sizes. This was found to be accurate in taking the linear displacement of the specimens. The analysis was further carried out to study various parameters like the percentage of horizontal and vertical web reinforcement, bending moment, shear strength, compression damage, and tension damage. Based on the results of this study optimum mesh size was proposed for further analysis.

Keywords: Mesh size, shear-moment interaction, horizontal web reinforcement, composite sections and linear displacement.

Paper ID	012031
Title	Influence of layer thickness and build orientation on compressive strength of 3D printed scaffolds prototypes
Authors	Kiran Kumar Sahu and Yashwant Kumar Modi

Abstract: The research on fabrication of customised porous bone scaffolds through additive manufacturing has been gaining momentum since last couple of years. This paper presents an analysis of compressive strength (CS) of two slightly different calcium sulfate based proprietary materials namely, Zp150 and VisiJet PXL Core. The comparison is performed on different layer thickness (LT) and builds orientation (BO) of ZPrinter®450 using full factorial design approach. Initially, a computer aided design (CAD) model of the porous scaffold with designed porosity is prepared in a CAD modelling software and then additive manufacturing is done on four different LT (0.089 mm, 0.101 mm, 0.112 mm and 0.125 mm) and three BO (along x-axis, y-axis and z-axis) of ZPrinter®450. Analysis of CS reveals that prototypes made of VisiJet PXL Core material have shown a better strength in comparison with their Zp150 counterparts for similar LT and BO. In general, prototypes of both the materials printed along x-axis posses better CS for all the LT. Moreover, the prototype of VisiJet PXL Core material fabricated along x-axis on layer thickness 0.089 mm possesses highest (1.17 MPa) CS among all the prototypes.

Keywords: 3D printing, Calcium sulphate, Compressive strength, Full factorial design, Porous bone scaffold.

Paper ID	012032
Title	Creeping flow around a spherical particle covered by semipermeable shell in presence of magnetic field
Authors	R. P. Namdeo and B. R. Gupta

Abstract: This paper deals the MHD slow viscous flow of electrically conducting fluid around a rigid sphere surrounded by a concentric permeable sphere. Darcy's law is adopted to describe the flow in semipermeable region and Stokes equation is applied to describe the flow of viscous fluid region. The stream functions are calculated for the both flow field. The resistance force on composite sphere is obtained and variation of drag force with respect to different parameters has been plotted graphically. Some limiting cases are deduced and compared with the solution derived in other research papers. We observed that drag force increases with increasing magnetic field.
Keywords: Modified Bessel function, Magnetic field, Drag force, Hartmann number, Semipermeable sphere.

Paper ID	012033
Title	Computational fluid dynamics and thermal analysis of a lithium-ion battery with different cooling system for electric vehicles
Authors	Seshaiah Turaka, P. Obulu and K. Vijaya Kumar Reddy

Abstract: Lithium-ion power battery has become one of the main power sources for electric vehicles and hybrid electric vehicles because of superior performance compared with other power sources. In order to ensure the safety and improve the performance, the maximum operating temperature and local temperature difference of batteries must be maintained in an appropriate range. In this paper presents the model designed with different type of heat pipe shapes modeling in CREO parametric software and analyzes the heat pipe with different mass flow inlets (30& 50L/min) thermal thermal analysis done in ANSYS to determine the temperature distribution and heat flux for two types of phase change materials (RT50 & Li Fe PO4). Also, CFD analysis to determine the pressure, velocity, heat transfer coefficient, mass flow rate and heat transfer rate for the different designs of heat pipe and different mass flow inlets. It has been observed that in thermal analysis the heat flux value is more for lithium ion phosphate phase change material (Li Fe PO4) than RT50 phase change material at U-bend heat pipes. Similarly in CFD analysis observed that mass flow rate, heat transfer rate, heat transfer coefficient values are increases by increasing the mass flow inlets and heat transfer rate more at straight type heat pipes as compared to bend type.
Keywords: Lithium-ion battery, Cooling System, Computational Fluid Dynamics, Thermal Analysis.

Paper ID	012034
Title	Barrier analysis of green supply chain management by interpretive structural modeling (ISM) technique
Authors	P.M. Mishra, Sudhir Sharma, Rajendra K Shukla and Alok Singh

Abstract: Industrialization plays a major role in the economic development, infrastructure, growth, and prosperity of any country. But these industries affect our environment so badly which causes global warming, the greenhouse effect, ozone layer depletion, acid rain, pollution, etc. Due to these threats, green supply chain management comes into the picture and many researchers are working on this. It will help in the sustainable development of society. With the help of the literature, we can know about drivers and barriers of Green Supply Chain Management. There are many methodologies like Interpretive Structural Modelling (ISM Technique), Regression Analysis, Questionnaire Process available which can analyze the effect and response of Green Supply Chain Management. This paper has analyzed some researches and shows the response of the industries which had surveyed; drivers and barriers of Green Supply Chain; Requirements for effective Green Supply Chain Management. The process of Globalization had imaginary convert the entire world into a single village. Rapid transportation and fast communication have encouraged manufacturers from across the world for remote business opportunities. In this context, neck to neck competition in price, quality, and post sell services has become the mandatory requirement of the market

Keywords: Green supply chain management, Interpretive structural modeling.

Paper ID	012035
Title	Seismic analysis of tall concrete and steel diagrid structure using response spectrum and time history method in E-Tabs
Authors	M Satya Sai Kiran Chowdary, Himath Kumar Y and Lingeshwaran N

Abstract: In the recent years due to lack of land the construction of high rise buildings widely increases and these buildings are affected by lateral loads due to wind or earthquake. To resist these horizontal loads lots of construction methods are available. Here in system peripheral columns of the building are eliminated. To resist the seismic forces we arrange the diagonal columns. In this study seismic performance of 20-story concrete and steel diagrid structures are assessed using response spectrum method. Only for concrete diagrid structure using time history method. The present work is made for studying the response and time period with acceleration of high rise building with concrete and steel diagrid structural system. To this aim response of two different diagrid structures of G+20 storey are carried out to obtain optimized position of diagrid. E-Tabs software mainly focus on seismic analysis of response spectrum and time history method. As per IS456:2000 and IS800:2007 all structural members of diagrid model are designed and IS1893:2002 and ASCE7-10 is considered for seismic analysis for concrete and steel diagrid structure. An evaluation of constraints storey shear, storey drift, storey displacement, Time period and Structural weight is done to determine the efficient and cost effective structure. The analysis of the building is carried out by using ETABS software.
Keywords: Concretediagrid, Steel diagrid, High rise structure, Response spectrum method, Time history method, Seismic analysis, E-Tabs Software.

Paper ID	012036
Title	Experimental and comparative analysis of zirconium oxide and flyash reinforced with heat treated Al 7075 aluminum alloy hybrid
Authors	P.M. Mishra , Ajay Tripathi and Sanjay Soni

Abstract: Aluminum Hybrid Composites are the new generation of metal composites that meet the latest requirements in advanced engineering applications. The mechanical properties of these requirements, the ability to use traditional processing techniques, and the possibility of reducing costs of aluminum hybrid components production are all fulfilled. Aluminum alloy 7075 is an alloy with zinc as aprimary alloying element. It is strong, with a strength comparable to many plates of steel, and has good fatigue strength and it has advanced properties like lightweight, corrosion resistance, high thermal conductivities, good mechanical properties, better wear resistance, low coefficient of thermal expansion as compared to the other conventional materials. Nowadays, Aluminum hybrid composites materials are more superior and demanding metal due to their The application of these metals is that is widely used in the field of Aerospace, Marine, & Minerals processing industries and many other industries due to their wonderful mechanical properties. AL 7075 one of the most superior grades of the Aluminum alloy to fabricating the single and hybrid composites materials. The stir casting method is extensively used to manufacture or fabricate composites materials.
Keywords: Zirconium, SEM, Aluminium Alloy, Hybrid Composite.

Paper ID	012037
Title	Experimental study on performance and emission character of C.I. engine fuelled with Plastic oil (PO) along with diesel fuel blending
Authors	Kawade Ganesh H, Tripathi Brajendra and Gothwal Suman

Abstract: In this experimental investigation evaluate the sound effects of plastic fuel in a single cylinder four stroke diesel engine. Plastic oil fuel produced from desecrate plastic with the help pyrolysis technique which most suitable for conversion. Also chemical and physical properties are tested for various blends as per the ASTM standard. Selected diesel engine tested with plastic oil and diesel fuel blend. Blending endowment selected for the testing of engine such as PO25, PO50, PO75 and PO100 for a load 25%, 50%, 75% and 100% of load of engine. In each experiment test, load on engine is increased and recorded the specific fuel consumption, mechanical efficiency, brake thermal efficiency. Also simultaneously measure the tail pipe emission of engine such as Carbon Monoxide, UBHC emission and Oxides of Nitrogen emission etc. obtained results are compared with standard performance characteristics of diesel engine. Finally these investigations prove the PO oil and its blending with diesel fuel are suitable for selected engine. Up to PO75 may use as a source of alternative fuel for CI engine without any major modification.
Keywords: Waste Plastic fuel, Properties of PO, Engine Performance, Emission.

Paper ID	012038
Title	Biomechanical matrix-multibody coupled human body model for seat to head transmissibility
Authors	Raj Desai, Anirban Guha and P. Seshu

Abstract: Health hazards of human body to whole body vibrations (WBV) have been linked with the incidence of spinal ailments within the drivers of vibrating moving equipment. The investigations on the biodynamic responsiveness of body segments; thus, it is relevant for a profound understanding of prospective impairment anticipations and design refinements. Current research work concentrates on seated body biodynamic direct and cross axis responses to seat induced vertical vibration, and establishment of an analytical model for the prediction of human anatomy comfort parameters. In the course of WBV vibrations of the human anatomy in a seated position (driver or passenger), the movement of the head is affected by the backrest forces transmitting to the lumbar section of the spinal column. Accordingly, it is crucial to reflect backrest assistance while building the human body model to captivate direct and cross axis seat to head transmissibility. Thus, the model results should accurately represent the internal forces, power absorbed, body acceleration accurately. The human anatomy is viewed as a biodynamic system of interconnected masses. A two-dimensional nine degree of freedom (DoF) matrix-multibody coupled backrest supported seated human anatomy model is established and validated to depict vertical and fore-aft head motion. Multi-objective genetic algorithm-based optimization has been used for model parameter identification by minimizing the error difference separating the experimental and model-derived seat to head transmissibility.
Keywords: Biodynamics, Matrix model, Multibodymodeling, Optimization, Vibrations.

Paper ID	012039
Title	Opportunities and mitigation strategies for biomaterials: To combat the challenges of COVID-19 outbreak
Authors	Shreyasi Paul and Shubhadip Paul

Abstract: In the last several months, "Coronavirus Disease 2019" (COVID-19) has intensified to a global pandemic at an abnormal rate. This pandemic of COVID-19 has disclosed major flaws in our abilities to attenuate spreading of contagious viral disease and provide treatment to patients, leading to a crisis in public health. Various Clinical views are discussed, considering the mitigation tactics and scope for novel biomaterials involved in treatment strategies, diagnostics and surface coatings for deactivation of virus. Call for multidisciplinary approaches in disease detection and management by biomaterials community are expected to play a vital role to combat the challenges of present and future outbreaks.
Keywords: Antiviral, Biomaterials, Pandemic, Diagnostics.

Paper ID	012040
Title	Review on various design aspects of the modern bicycle
Authors	D Baviskar, A Bhosale, A Baswa and K Kulkarni

Abstract: In today's world where we are surrounded by the smoke emitting vehicles, we must come up with more effective and sustainable solutions for transport. One of which is electric vehicles and other being bicycle. Since the innovation of bicycles till date a lot of improvements are done in its design, utility, and applications. Bicycle riding is one earliest modes of transport. Being so, it is the cleanest way of transportation as does not create any waste out of it. Bicycle riding is also considered as one the most effective ways of exercising. Bicycles find the largest market in the vehicle industry as it attracts small kids right from the age of 4yrs to senior citizen. The advancement in the field of ergonomics plays vital role in doing so. The developments on design and power transmissions have also up lifted the bar for utility. Due to this the application of bicycles now is not limited to simple exercising, racing, or travelling but also in the field of adventure sports, mountain climbing etc

Keywords: Material frames, Transmission system, Electric bicycle, spoke-less and center-less wheel.

Paper ID	012041
Title	Evaluation of the effective mechanical properties of palm oil fuel ash based fiber reinforced concrete
Authors	Kristam Srikanth, Durga Chaitanya Kumar Jagarapu, T Venkat Das, Syed Hamim Jeelani And Arunakanthi Eluru

Abstract: Cement concrete is one of the utmost regularly used building materials next to water. But one tonne of cement produces 1.25 tonnes of CO_2 and pollutes the environment. To keep that in mind, in this study the cement is partially replaced with POFA (palm oil fuel ash) up to 30% (5% equal intervals), and steel fibers are added to the volume of concrete by 0.5% apart from normal concrete. Generally, POFA is one of the Agro-Industrial garbage materials which is coming as of the palm oil industry, with the growing amount of waste produced from the different processes there has been an increasing the waste generation. Increasing intrust in the use of agro – Industrial waste to achieve the potential advantages. Comparing with cement, POFA contains a high silica content. specimens are cast with M40 grade of concrete. The prepared POFA based Fibre reinforced concrete (FRC) was tested for all types of mechanical properties, like compressive strength, split tensile strength, bending strength, and load-deflection curve. All these properties are compared with the nominal concrete

Keywords: POFA, Steel Fibres, FRC, Mechanical properties, and Agro-Industrial waste.

Paper ID	012042
Title	Effect of coir fibres on strength, thickness and cost of PMGSY roads
Authors	Ayush Mittal

Abstract: The present study discusses about the effect of adding coir fibres in poor soil in various percentages (i.e. 0.15%, 0.30%, 0.60%, 0.90%, 1.20% and 1.5%) on the strength, thickness and cost of low volume rural roads under PMGSY. Soil sample contains substantial amount of fines and is classified as clay of high compressibility (CH). Laboratory compaction and California Bearing Ratio (CBR) tests are conducted for various reinforcement conditions. The results indicate improvement in dry density and CBR with increase in fibre content upto 0.90% and beyond that it decreases. The thickness of pavement is determined as per design catalogues provided in IRC:SP:72-2015. Maximum cost reduction of 21% and 19% in pavement construction corresponding to traffic category T-6 and T-9, respectively, is reported when reinforced with 0.90% coir fibres.
Keywords: Coir, Pavement, Reinforcement, Poor Soil, PMGSY.

Paper ID	012043
Title	Developed software for automation toolpaths for laser processes
Authors	Igor Ortiz, Piera Alvarez, M Angeles Montealegre, and Carles Creus Lopez

Abstract: Additive manufacturing started in the eighties as a new technology for repairing added value parts. The additive manufacturing technology is based to produce complex features layer by layer, without using complex tooling. For programming coating toolpaths, many operator hours are needed, a software is necessary to facilitate this task of programming complex 3D geometries. A customized CAM-system for laser metal deposition is needed. The objective of this work is to introduce the new software developed by Talens System. This software has been designed for automating the toolpaths and process parameters researched and validated in our laser machine tool, for additive manufacturing as well for laser hardening.
Keywords: Additive Manufacturing, Laser metal deposition, software, toolpaths, CAD/CAM, Coating.

Paper ID	012044
Title	Development of a low-cost monitoring system for open 3d printing
Authors	M S Khandpur, M Galati, P Minetola, G Marchiandi, L Fontana and V Stiuso

Abstract: 3D printers for Rapid Prototyping and Manufacturing have been widely accepted by large industries and in many small scale industries or by many hobbyists. Due to its nature of layer by layer addition to form a product, identifying defects between the layers can be a crucial strategy to determine the quality of a product by carefully monitoring this process to avoid any failures or abysmal print quality. This kind of approach gives an advantage in the applications where rapid prototyping of products requires high customization without compromising the quality. In this work, a low-cost camera is installed in an open 3D printer, and computer vision algorithms are used to implement an in-situ monitoring system. The defects can be evaluated by comparing the Printed layer to its open G-code. This G-code printing file is also modified to introduce the image capture sequence step after each layer. The value of the area of missing or exceeding material is returned to the user with their corresponding images. A decision can be made to abort the job in case of important defects to avoid unnecessary waste in material, time and costs.

Keywords: 3d printing, Monitoring, Defects, Image analysis.

Paper ID	012045
Title	Improvement in engineering properties of clay soil using waste demolished material
Authors	Gaurav Jain, Prem Prakesh Pandit and Manoj Narwariya

Abstract: Expansive soil contain the highly active clay mineral in the form of montmorillonite due to which expensive soil swell upto 7% upon adding 1% of water, which may lead to unequal settlement of subsoil. This research represent a complete framework to overcome this drawback of expansive soil by adding waste material like fly ash and brick waste to clay soil in order to improve its engineering properties. Fly ash can be easily obtained from coal combustion plants while brick waste is easily available at demolition area. In this research fly ash is added in different percentages 0%, 4%, 8%, 12%, 16% and brick waste is added 5%, 10%, 15%, 20%, 25% by weight of soil. The results of test show that the addition of fly ash and brick waste reduces the liquid limit, plasticity index, optimum moisture content, % free swell index and increases unconfined compressive strength with increasing California bearing ratio value.

Keywords: Fly ash (FA), brick waste (BW), Liquid Limit (LL), Plastic Limit (PL), Plasticity Index (PI) California Bearing Ratio (CBR), Unconfined Compressive Strength (UCS).

Paper ID	012046
Title	Sustainable use of polypropylene fibers and palm oil fuel ash in the production of geopolymer concrete
Authors	Bala Gopal Adapala, Durga Chaitanya Kumar Jagarapu, Syed Hamim Jeelani, B. Sarath Chandra Kumar and Arunakanthi Eluru

Abstract: Geopolymer concrete is an innovative advance in the world, in this concrete cement is fully substituted with pozzolanic materials like fly ash and GGBS. In this present study fly ash is replaced with POFA (Palm oil fuel ash) up to 25% (0%,5%,10%,15%,20%,25%), 10% of stone dust is replaced with sand. In addition to the above materials, 0.2% of polypropylene fibers were added to the volume of concrete. 2.5 ratio of sodium silicate and sodium hydroxide solutions are added as Alkali activators for 10M molarity. Initially, the specimens are oven cured 80o C for about 24hrs and after that leave for ambient curing. All the specimens stood tested after 7 and 28 days of ambient curing. The prepared POFA based geopolymer was tested for all types of mechanical properties, like compressive strength, split tensile strength, bending strength and load deflection curve. All these properties are compared with the nominal concrete.

Keywords: POFA, stone dust, polypropylene fibers, geopolymer concrete, Mechanical properties, and ambient curing.

Paper ID	012047
Title	Experimental testing of 3D printed polymeric heat exchangers
Authors	L Fontana, P Minetola, F Calignano, L Iuliano, M S Khandpur and V Stiuso

Abstract: Unlike conventional manufacturing technologies, additive manufacturing and 3D printing empower engineers with much more design freedom. Heat exchangers with complex internal channels or lattice structures can be designed for layerwise manufacturing by maximizing the surface to volume ratio. Low-weight polymeric heat exchangers are employed in aviation and aerospace applications. For increasing the thermal performance of polymers, additives can be used such as graphene. In this study, a Grafylon filament is used for the production of a simple heat exchanger by 3D printing. The heat exchanger is composed of two external shells and an interior duct with a two-stage 45-degree bend. For watertight purposes, the duct is manufactured by selective laser sintering of polyamide powder. Two replicas of the shells are fabricated by 3D printing of Grafylon and acrylonitrile butadiene styrene (ABS) respectively. The thermal performance of the two materials is experimentally tested and compared also to numerical simulations. The results of the study show that the Grafylon filament provides enhanced thermal performance to 3D printed heat exchangers of polymeric material.

Keywords: 3D printing, grafylon, thermal behavior, heat exchanger.

Paper ID	012048
Title	Experimental assessment of compensated distortion in selective laser melting of Ti6Al4V parts
Authors	V Stiuso, P Minetola , F Calignano, M Galati, M S Khandpur and L Fontana

Abstract: Selective laser melting (SLM) is a well-established Additive Manufacturing technique for the fabrication of end-use metal components. Process reliability and maximum product quality are ensured by 20 years of technology development. Nevertheless, depending on the complexity of the part geometry and on the operator experience, different trials are often needed before getting a part first time right. To reduce the number of failed jobs, simulation software packages predict residual stresses and related distortions in SLM parts and propose a compensated geometry for the "right first time" production of the product. In this works, the simulation routines of Amphyon software by Additive Works are experimentally calibrated and validated for the fabrication of a reference geometry by means of an EOSINT M270 machine and Ti6Al4V powder. The calibration of Amphyon is performed using three cantilever specimens and the calibrated SLM simulation is then used to compute the compensated shape of the reference part. The validation of the compensated shape by comparison to the real part geometry shows that Amphyon routines have good prediction capability and dimensional accuracy.

Keywords: Additive Manufacturing, Laser powder bed fusion, process simulation and Ti6Al4V.

Paper ID	012049
Title	Development of ecosystem for effective supply chains in 3D printing industry – An ISM approach
Authors	S Singh and V Agrawal

Abstract: 3D printing (3DP) is an important technology to manufacture the objects of intricate designs that are otherwise not possible for traditional manufacturing. This technology has witnessed growth in research papers in the last decade that shows the increasing interest of researchers and users in this technology. Many researchers have predicted and written about the unimaginable new supply chain configurations after the large-scale adoption of 3D printing. A supply chain is a lifeline for any business because it drives the business by satisfying customers' demands economically. This study was undertaken to explore the factors that are critical for developing a supply chain ecosystem for the 3DP industry. The study used the literature of the relevant research papers, conference articles, additive manufacturing business reports, and supply chain management (SCM) research papers & articles on 3D printing technology. This study highlights factors that are critical for the supply chain ecosystem for the 3DP industry. Interpretive Structural Modelling (ISM) methodology identified interactive association among those factors. Impact Matrix Cross-Reference Multiplication Applied to a Classification (MICMAC analysis) has classified those factors into four categories for better understanding and strategy making. The stakeholders in the 3D printing industry can draw insights from the output of this study. Researchers can do further research on these factors for the benefit of sustainable supply chains in the 3DP industry.
Keywords: Supply Chain, Supply Chain Management, Additive Manufacturing, 3D Printing.

Paper ID	012050
Title	Dynamic analysis of laminated composite sandwich plates with a circular hole
Authors	Deepak Kumar, Vinayak Kallannavar, Subhaschandra Kattimani, B. Rajendra Prasad Reddy

Abstract: The current manuscript pacts the finite element investigation of the modal characteristics of the laminated composite sandwich (LCS) plate containing a circular hole. A series of simulations are executed to examine the influence of fiber orientations, edge constraints, the ratio of the thickness of core to face sheet, the radius of hole, and location of the hole on the system on the frequency response of the system. The analysis are carried out using ANSYS simulation tool
Keywords: Finite element analysis, Laminated composite sandwich plate, Plate with the hole.

Paper ID	012051
Title	Comparative study of pressure variations in water distribution network due to change in location of elevated service reservoir.
Authors	Arun Reddy Thumma and A. Aravindan

Abstract: This paper compares the pressure variations in a water distribution system due to a change in the location of an elevated service reservoir with an intermittent type of supply for a continuously increasing demand. For this study Water Gems connect edition software is used for the design of a water distribution network. This study is conducted in the Eturnagaram habitation of Mulugu district. The Water Distribution Network is designed for 30 years with PVC as pipe material and intermittent type of supply. Further, this water distribution system is analyzed for pipe bursts and proposes a framework for the operation and maintenance of the water distribution network.
Keywords: Water distribution system, Water Gems, Pressure variations, Operation and maintenance, Pipe networking.

Paper ID	012052
Title	Novel reactive power compensation technique for an inductive load connected with micro grid
Authors	S. Arockiaraj, Sakthisudhursun , M. Jawahar and A Suban

Abstract: The modern power factor repair process using Ardunio Mega2560 provides fast, easy and efficient power adjustment among other methods. Adjusting the active factor of the incoming load will reduce the amount of active energy. The speed of adjustment for proper identification of the power factor was performed using the Ardunio Mega2560. The incoming load causes a lower power factor so by using the appropriate system such as Ardunio Mega2560, the appropriate capacitor bank and other components the problem is solved and the results are obtained with MATLAB verification .Whenever the power factor deviates from the required value or it is automatically closed and saves it at all times. The Ardunio Mega2560 is connected to the MATLAB and the power level is available.
Keywords: Ardunio, PFC, power factor, ATmega.

Paper ID	012053
Title	Grey wolf optimizer and other metaheuristic optimization techniques with image processing as their applications: a review
Authors	Alok Kumar, Lekhraj, Safalata Singh andAnoj Kumar

Abstract: Image processing is an evolutionary field in the domain of computer vision that currently has a comprehensive spectrum of applications. It is being employed in image segmentation, image classification, medical imaging, image compression, etc. A lot of realworld prominent issues are tackling employed through these application techniques. These techniques can be employed by means of various algorithms; however, these offered immensely dominant outcomes with existing and modified optimization algorithms. Some of the metaheuristic optimization algorithms applied during the above techniques include Ant Colony Optimization (ACO), Genetic Algorithm (GA), Bat Algorithm (BA), Grey Wolf Optimizer (GWO), Evolutionary Strategy (ES), Particle Swarm Optimization (PSO), Genetic Programming (GP), and so forth. Hence, this manuscript's main objective is that the study of several applied optimization algorithms and their variants thus lead to the various domain of image processing concludes it work more efficiently and robustly.
Keywords: Grey Wolf Optimizer, Metaheuristic Algorithms, Support Vector Machine, Image Segmentation, Image Classification, Medical Imaging, Image Compression.

Paper ID	012054
Title	Development of novel single source precursor of tin for deposition of tin oxide thin films for various applications
Authors	Priyanshu Sharma, Santosh Kumar Tripathi and Piyush Jaiswal

Abstract: Novel single source organometallic precursor, Triethanolamine Tin (II) (Sn-TEA) was synthesised by the reaction of $SnCl_2$ and triethanolamine in presence of Sodium acetate. The Sn-TEA precursor was characterized by TGA, FTIR, 1H and 13C NMR to confirm its thermal stability and predict its molecular structure. The 1H and 13C NMR showed formation of organometallic molecule as TEA and acetate form a coordination sphere around the Sn atom in a stable structure. The TGA showed two thermal decomposition steps at ~206.14oC and ~750oC and residue at 800°C. The precursor was pyrolysed at 400oC and residual powder was characterized by FTIR which indicated formation of Tin Oxide. The precursor was then used to deposit SnO_2 films by microwave assisted solvothermal process on glass substrates. The films were characterized with XRD, FESEM and tested for conductivity. XRD confirmed the formation SnO_2 of cubic lattice. The effect of precursor concentration and microwave irradiation time on the film morphology, compositional analysis and electrical conductivity was studied thoroughly. Sn-TEA complex proved to be a potential single source precursor for SnO_2 production and it can be applied to develop highly pure/doped SnO_2 films for gas sensing applications in cost effective manner.
Keywords: Organometallic precursor , Microwave- irratiated process,SnO_2, Gas sensing.

Paper ID	012055
Title	Characterization of waste plastic in flexible pavement
Authors	Balram Singh Rajput, Sachindra Pratap Singh Rajawat and Gaurav Jain

Abstract: The degree of waste plastic in metropolitan strong waste (MSW) is escalating because of growth in populace, urbanization, improvement exercises and way of life changes that have prompted far reaching finishing. Since, these aren't orchestrated deductively and believability to make ground water source defilement. This plastic waste material midway substituted the standard material to enhance needed mechanical ascribes designed for explicit road mixture. In the standing research made methodologies to utilize waste plastic for improvement inspiration driving roads and versatile black-tops has explored. In standard road construction, majorly bitumen is utilized as folio. For the top most layer of flexible black top bitumen can be modified with bitumen blend and lavish plastic pieces. This waste plastic altered bitumen mixture shows improved limiting properties, sufficiency, thickness and impenetrable to water

Keywords: Aggregate, Bitumen, Waste plastic, Plastic-coated aggregate (PCA), Plastics coated aggregate with bitumen, Polymer modified bitumen (PMB), Marshall stability.

Paper ID	012056
Title	Parametric analysis of hole circularity for laser percussion drilling of carbon fibre reinforced plastic using Nd: YAG Laser
Authors	Yadvendra Kumar Mishra, Sanjay Mishra, S C Jayswal and Ajay Suryavanshi

Abstract: Holes of diameter less than 1 mm has wide application of manufacturing sector. Laser beam can be conveniently used for creation of such hole in different materials. The Carbon Fiber Reinforced Composite (CFRP) is quickly replacing the conventional materials in most of the engineering applications. Therefore, a detail parametric study to analyse the influence of factors like laser current, laser interaction time, pressure of assist gas, workpiece thickness and incidence angle on the geometrical accuracy of hole in terms of hole circularity at top (HCT) has been explored by changing the individual contributing factors. Small holes (< 1mm) have been fabricated with Nd: YAG laser of millisecond pulse duration in CFRP workpiece of thickness 1mm, 3mm, and 5 mm. It was observed that hole circularity at top surface is highest for zero angle of incidence. The increase of laser current, interaction time, and pressure of assist gas increases the HCT when the laser direction is normal to the workpiece whereas it shows a decline trend when the angle of incidence of 10o and 20o . The increase of workpiece thickness reduces the HCT irrespective of angle of incidence.

Keywords: Statistical modelling, parametric analysis, hole circularity, Nd: YAG laser, Laser percussion drilling.

Paper ID	012057
Title	RCC chimney for 800MW thermal power plant
Authors	Tulasi Sai Krishna and Ch Mallika Chowdary

Abstract: A Chimney is an industrial structure used to ventilate hot flue gases from the furnace to the outside living atmosphere. The Chimneys are typically vertical, or as near as possible to vertical, to ensure that the gases flow smoothly. As a result of the procedure of chimney is ability to handle Dead load, Wind load, Earthquake load and Temperature load. In this research, a chimney is starting from basic calculations to analytical calculations. A Chimney analysis for the thermal power plant, the location was taken as Vijayawada, (AP). Where as the basic wind speed and seismic zone were considered only in that particular location. Analysis was about how to calculate the height, calculating area and volume if the thermal plant generates 800MW power. Analysis was calculated by using Indian code IS 4998-2015.in manual and software. STAAD Pro and ANSYS are the softwares used for the validation.
Keywords: Chimney, Wind loads, STAAD Pro, ANSYS, Manual work.

Paper ID	012058
Title	Palm oil fuel ash as partial substitute to cement in concrete: performance at elevated temperatures
Authors	U.V. Narayana Rao and N.Venkata Sairam Kumar

Abstract: In this paper, the palm oil fuel ash (POFA) concrete is produced using POFA as partial replacement to cement (0%-P0, 20%-P20, 40%-P40 and 60%-P60) by weight. The POFA concrete specimens are subjected to elevated temperatures of 200oC, 400oC and 800oC for duration of 2 hours. The compressive strength, ultrasonic pulse velocity (UPV) and mass loss (%) of POFA concrete are evaluated. The results indicate that the compressive strength is enhanced by the use of POFA in concrete. At elevated temperatures, POFA concrete showed higher resistance than P0 concrete (control concrete) and P20 concrete showed best performance in POFA concrete, when subjected to elevated temperatures. From the experimental results, it can be observed that 20% POFA can be used as partial replacement to cement in producing sustainable concrete.
Keywords: Concrete, elevated temperatures, Palm oil Fuel ash, sustainable concrete.

Paper ID	012059
Title	Deep learning based optimum fault diagnosis of electrical and mechanical faults in induction motor
Authors	Vikas Singh, Purushottam Gangsar, Ashok Atulkar and Rajkumar Porwal

Abstract: Among all the motors Induction motor (IM) plays a vital role in industry and the demand for their reliability and safe operation is increasing day by day. They are reliable but they do wear out if not maintained timely which in turn will lead to excessive loss of revenue and also man power and this motivates us to develop an intelligent methodology for diagnostic of incipient faults in Induction Motor. This paper focuses on the development of optimum Deep Learning based diagnostic technique to detect the mechanical and electrical faults in Induction Motor. Here, mechanical and electrical faults of different severity level are being tested on machine fault simulator using acquired current and vibrational signals. In this work, optimum model of Deep Neural Network (DNN) based on critical vibration and current features is developed and finally used to timely and effectively detect that which kind of faults the given IM is dealing with. The results are added and discussed in the result and discussions.

Keywords: Induction motor, electrical faults, mechanical faults, deep neural network, overall accuracy, loss percentage, overfitting, relu and softmax.

Paper ID	012060
Title	Experimental study on dimensional accuracy of freeform fabricated thermoplastic polyurethane
Authors	Tarun Bhardwaj, Pradeep Jain and Devendra Singh

Abstract: Fused filament fabrication (FFF) is the prominent additive manufacturing (AM) process used for fabrication of customized parts using layer-by-layer approach by fusing the filament. The challenge in FFF AM process is to improve the dimensional accuracy of parts. To overcome this challenge, the aim of this research article is to enhance the dimensional accuracy of FFF Thermoplastic Polyurethane (TPU) parts by optimizing the various process parameters settings. In this research, process parameters affecting the dimensional accuracy are examined utilizing the Taguchi based design of experiment (DOE) approach. Main effect plots for mean and SN ratio are drawn to investigate the effect and dominance of each parameter. This study helps to fabricate the TPU using FFF with high dimensional accuracy.

Keywords: Design of experiments, Process parameter optimization, Thermoplastic polyurethane and Dimension accuracy.

Paper ID	012061
Title	Review of structural health monitoring attributes optimization with multiple regression and teaching learning based optimization
Authors	Ashish Khaira, Ravi K. Dwivedi and Sanjay Jain

Abstract: It was observed in reviewed literature that researchers preferred Weibull analysis for analyzing failure, as it is a generalized uncertainty failure model, based on variable failure rate in structural health monitoring (SHM). Apart from this, in real-life situations, it is difficult to get all the required data for the standard objective function, therefore, some researchers used some pre-existed values in place of unavailable ones, but it usually leads to error. To reduce this error, this research work reviewed Multiple Regression and Teaching Learning Based Optimization (TLBO). This review suggested combining Multiple Regression and Teaching Learning Based Optimization (TLBO) for successful structural health monitoring (SHM).

Keywords: Failure analysis, TLBO, optimization, condition based maintenance (CBM), regression, structural health monitoring (SHM).

Paper ID	012062
Title	Optimization of structural health monitoring attributes under variable failure rate condition using teaching learning based optimization and multiple regression
Authors	Ashish Khaira, Ravi K. Dwivedi and Sanjay Jain

Abstract: The manufacturing industries prefer to use exponential equations for evaluating reliability, failure rate, etc., while assuming failure rate constant, but in real life failure rate is not always constant. This research work proposes a novel combination of Multiple Regression and Teaching Learning Based Optimization (TLBO). This work starts with regression modeling, to form an objective function from available data; secondly TLBO technique used, to obtain optimum values of structural health monitoring (SHM) attributes through cost minimization and finally, Weibull analysis to check the effect of optimum values of SHM attributes on β. The final results indicated that the β parameter reduces, which symbolized reduction in failure rate & SHM cost and, improvement in system reliability, thus validates the adopted methodology of combing multiple regression with TLBO, thus success of this work become the backbone for intelligent structures for SHM system.

Keywords: Failure analysis, TLBO, optimization, condition based maintenance (CBM), regression, structural health monitoring (SHM).

Paper ID	012063
Title	Polymer nanocomposites with nanostructured copper flakes for protection as barrier in packaging materials in food Industry
Authors	Sudha R Karbari , Kiran Guru Prasad Shetty and Nivedita S Desai

Abstract: Polymer nanocomposites as multilayered and single layer are used as barrier protection for the entry of UV and moisture. Here the polymer nanocomposites with novel nanoflakes are simulated with the optimized geometry of nanoflakes. The barrier properties are verified with the change in width of the dispersed nanoflakes of polymer matrix. The optimization of the copper nanoflakes is investigated and studied using two model with different dimensions of the nanoflakes in the polymer nanocomposite. The diffusivity flux at the interface of air and the polymer matrix varies from 5×10^{-12} mol/(m2 s) and 4×10^{-5} mol/(m2 s) for the models proposed.
Keywords: Nano flakes, Nano packaging.

Paper ID	012064
Title	Glycosuria sensing based on nanometric plasmonic polaritons
Authors	S Sahu, P K Jain, N Mudgal and G Singh

Abstract: Surface Plasmon waves exhibit an interesting characteristic of enclosing light above the diffraction limit. In this work surface plasmon sensor using Metal-Insulator-Metal configuration is demonstrated for an application of Glycosuria detection. The sensing device possesses a slot waveguide and an elliptic cavity in a metallic substrate. On injection of TM polarized mode, surface plasmon wave coupled with cavity causes the generation of resonating modes which is used to analyze the concentration of glucose in urine. The simulation study is performed using the Finite difference Time Domain (FDTD) method. The sensitivity of the sensor is 792.8 nm/RIU and the figure of merit is 113.25. Based on the analysis it is remarked that the device is suitable for an on-chip application.
Keywords: surface Plasmon, refractive index sensor, biosensor.

Paper ID	012065
Title	Effect of ball Powder Ratio on microstructure and compressive behaviour of porous Ti-4wt % Al alloy
Authors	Pradeep Singh, P. Agarwal, J P Shakya and D.P. Mondal

Abstract: Ti and Al powders were milled in the weight proportion 24:1 using a high energy planetary ball mill. Ball to powder ratio (BPR) was varied (10, 15, and 20) in the milling process. Powder mixture milled with different BPRs were characterized by the XRD and FESEM to probe the evolution of phase and particles shape and size. Further, these mixtures were used to make porous cylindrical samples through powder metallurgy and space holder technique. The used amount of space holder was 60 v%. Compression test of the samples were performed on Universal Testing Machine. It was analysed that crystallite size, shape and size of the powder particles considerably affected by the used ball to powder ratio. XRD confirms that phase formation is invariant with the BPR. The observed relative density is about 10% higher than the used space holder content. Porous sample synthesized by the powder milled with 15 BPR has higher plastic collapse stress and energy absorption capacity as compared to the samples made of the powder milled with 10 and 20 BPRs.
Keywords: Metal foam; Mechanical alloying; Ball Milling; Space holder.

Paper ID	012066
Title	Harmonic analysis of annular sector sandwich plate using FEM
Authors	M Kumar , M Narwariya and A K Sharma

Abstract: In present study, vibration and harmonic behaviors of annular sector sandwich plate of two orthotropic composite materials are analyzed using FEM technique. Sandwich plate made of two face sheet and one core sheet in middle has been modelled using an ANSYS APDL FEM tool. A suitable finite element model is developed and proposed based on first order shear deformation theory. The model has been discretized using appropriate elements i.e. 8-node solid 185 for core sheet and SOLSH190 for face sheet from the ANSYS element library. Effect of varying face sheet thickness is demonstrated on vibration as well as harmonic behaviors of sandwich plate and related findings are discussed briefly. Effect of sector angle has also been demonstrated. The authenticity of the proposed methodology has been verified by comparing the simulation results with available literature. It can be observed that the results obtained are in good propinquity and presently proposed model shows the results with adequate accuracy.
Keywords: Sandwich plate, Sector Angle, Harmonic Behavior, Mode Number, Resonance, FEM.

Paper ID	012067
Title	Analysis of BIM application trends in construction industry for waste reduction and sustainable outcomes
Authors	Narmada Vadlamudi, Bommareddy Sesha Sai Ratnamala and V Sree Lakshmi

Abstract: The examination has built up a structure for BIM-based authoritative abilities advancement for upgraded appropriation and compelling utilization of Building Data Demonstrating (BIM) inside the Indian engineering associations. In the past examination, a requirement for changing the conventional practices in Indian development area has been more than once communicated. A near concern has moreover been showed up to advocate for the use of lean and sustainable concepts to boost productivity and lead a group of development projects in India; to minimise flaws in the exercises and increase the hold subsidises related to capital, electricity, and cost. As a result, this review aids the plan partnership by recommending the use of BIM as a system that encourages them to consider lean and sustainable changes. BIM was identified as an empowering agent and a cycle for achieving lean and sustainable results on development projects in order to meet the examination objective. Examination was led through a successive blended technique method zeroing in on gathering and breaking down together subjective and quantifiable information. The examination was isolated in quaternion stages: Poll study information assortment and experimental investigation of information including partial Least Square (PLS-SEM) examination to comprehend the ebb and flow status of BIM selection, its drivers, inhibitors and suggestions inside compositional associations in India; Semi- organized meeting and centre gatherings for interpretive examination of local BIM capacities and BIM abilities through Interpretive structural modeling (ISM); broad writing audit to contemplate and recognize the lean and sustainable results; and contextual investigations examination through quantitative comparative analysis (QCA) to approve the proposed structure. The exploration discoveries demonstrate that BIM appropriation venture for designers is in experimentation phase and the contemporary use of BIM which is not investigated to maximum capacity. Structure was created by way of a component of this investigation bequeath empower design associations to effectively accept BIM on tasks headed for acquiring sustainable and lean advantages.

Keywords: Building information modelling (BIM), lean and sustainable.

Paper ID	012068
Title	Microstructure and mechanical properties of friction-stir welded interstitial-free steel using WC tool
Authors	Mrinmoy Sinha, Atul Kumar, Ajay Tripathi, Surendra Kumar Chourasiya.

Abstract: In the present work, interstitial-free steel plates were joined using friction-stir welding. The weld integrity was found to be in excellent condition. This work emphasises the evolution of microstructure and the enhancement of mechanical properties by friction-stir welding. The microstructural characterisation using optical image microscopy revealed the refinement of grains in the nugget zone. Vicker's hardness test stopped to a maximum of ~91 VHN in the nugget zone compared to ~40 VHN in the base material. The tensile test of the welded sample concluded that the samples fractured in the region away from the nugget zone and towards the base material. The results are conclusive that friction-stir welding is an excellent approach for joining interstitial-free steel components for automotive applications. Keywords: Friction-stir welding, Interstitial-free steel, Microstructural characterisation, Micromechanical behaviour.

Keywords: Friction-stir welding, Interstitial-free steel, Microstructural characterisation, Mechanical properties.

Paper ID	012069
Title	Electronic waste: overview, recycling and metal extraction methods
Authors	VSree Lakshmi, Ch Rahul Satya and D Nikhil Aravind

Abstract: Water pollution and contamination is a major environmental issue throughout the world. As the world is urbanizing rapidly at an increasing rate the water bodies are getting toxic. Rivers, canals, and even groundwater are getting contaminated by various manmade activities. One of the major issues of water pollution is disposing and dumping waste into the water bodies. It is considered one of the most polluting anthropogenic activities. Out of all the different types of waste, e-waste is recorded as a rapidly growing waste stream in the world. Many electronic scrap materials that contain potentially harmful materials are dumped into the water bodies. It contains mainly raw materials like iron, copper, steel, etc. Every year electronic waste of 50 million tones is being generated globally. According to the estimate given by EPA, only 20% of the e-waste is recycled and the remaining waste is sent to incinerators or dumped into landfills and water bodies. E-waste is increasing due to the swift changes and high usage of technology, falling prices, and the invention of new devices, and the outdating of old processors. Over 50% of the e-waste consists of ferrous materials and it can be processed and extracted by mechanical shredding, hydrometallurgical methods, and bioleaching, etc. In this study, with the help of these methods, we can extract valuable metals like Cu, Al, Ag, Au, converting e-waste pollution threats into metal resources thereby increasing the revenue and economy of the country. Sustainable e-waste management practices can reduce waste contamination and the health risk from different harmful materials like dioxins, cadmium, chromium, radioactive isotopes, etc.

Keywords: e-waste, metal extraction, PCB's (printed circuit boards), pyrometallurgy, hydrometallurgy, leachate, bio-metallurgy, bio-leaching, metal solubilisation, metal recovery.

Paper ID	012070
Title	Effect of notch fillet radius on tensile strength of 817M40 notched bar
Authors	Aditya Singh, Premanand S Chauhan, Prem Prakash Pandit and Manoj Narwariya

Abstract: 817M40 steel is a popular grade of hardening alloy steel to its excellent machinability. It is manufactured the mechanical components like gears, shafts, studs and bolts. Its hardness in the range of 248/302 HB. In this paper, notch fillet radius effect on tensile loading was investigated. Ushaped notched bars with three different kinds of notch were employed for tensile testing specimens. The changing the notch root radius and keeping the gross diameter, net diameter and notch depth same for all the notches. The notch root radius is varied as 0.5, 1.0 and 1.5 mm. The experimental results were validated with simulation result conduction on Finite Element Tool ANSYS Workbench. Authors belief that different notch fillet radius may have significant impact on tensile strength.
Keywords: Notch, Fillet Radius, 817M40, Notched Bar, Tensile Strength.

Paper ID	012071
Title	Investigating the influence of single-pass and double-pass friction stir processing on mechanical and wear behaviour of AA5083/Al$_2$O$_3$ surface
Authors	Shalok Bharti, Nilesh D. Ghetiya, Kaushik M. Patel and Varun Dutta

Abstract: Friction Stir Processing (FSP) has been established as an efficient technique to manufacture surface composite. Since the development of FSP, a variety of surface composite coatings have been produced with the help of this technique. Surface composite provides an enhancement in various properties of the base material by providing a coating layer of composite material on the parent material. Various FSP process parameters can affect the produced surface composite and its properties. One of the important FSP parameters includes the number of passes over the surface of a material. In this paper surface composite of AA5083/Al2O3 was produced using FSP. Single-pass and double pass FSP were employed to understand its effect on microhardness, tensile strength, microstructure coefficient of friction, and wear rate. It was observed that the double pass aided to produce the homogeneously dispersed reinforcement particles in the surface composite along with fine grain microstructure. FSP helped to enhance the microhardness from 79.5 HV in the parent material to 136.5 HV in double pass FSP. Moreover, FSP helped to increase the tribological properties after two passes. However, the ultimate tensile strength of the produced surface composite was reduced after FSP.
Keywords: Friction Stir Processing, Multi pass, Surface composite, AA5083, Al$_2$O$_3$, Tensile strength.

Paper ID	012072
Title	A novel design of bioinspired retinal vascular network-based microchannel for LOC applications
Authors	Sudha R Karbari and Kiran Guruprasad Shetty

Abstract: Microchannels are identified as important components that transfer liquids within a minute area for microfluidic applications. Pressure controlling is an efficient and most accurate way to introduce a certain velocity of equipment. In this study, we described the simulation analysis for microfluidic channels with three inlets and one outlet and went on to optimize it to two inlets and one outlet with appropriate velocity profiles and pressure profiles. The grooves in the microchannel draw inspiration from the vascular network of the retina which is a dynamically interconnected structure composed of three planar vascular layers with bends and grooves at its tip ends. Different fluids enter the inlets and are supposed to get mixed as much as possible before leaving the outlet. The geometry needs to be modified to increase the mixing of the two fluids within 0.05 sec. A passive approach to induce mixing of the biological samples is facilitated by increasing the distances. The fluids travel longer distances for mixing because of diffusive and inertial forces for which the volumetric fluids travel long before mixing takes place. The channel length is increased by introducing groove along the center of each channel to increase the length for the mixing

Keywords: Microchannel, Modelling, Simulation, Velocity, Pressure, COMSOL Multiphysics.

Paper ID	012073
Title	Design and optimization of piezo resistors for a graphene based MEMS ICP Sensor
Authors	Sudha R Karbari , Yathish D Vahvale and Karthik Kumar

Abstract: In this project the modeling and simulation of MEMS Intracranial pressure sensor using Graphene as the structural layer is defined. At normal health condition, the ICP pressure is in the range of 10-15 mmHg. Any variation from this range will signify the abnormalities such as neural system malfunction, nausea, vomiting, paralysis, brain tumor rupturing, and excitement. The purpose of the project is to monitor abnormal mental situation which is a result of slight variation in cerebrospinal fluid pressure. For Intracranial pressure sensing applications, to measure this slight variation of pressure a sensor having high sensitivity need to be employed and is solely depends on membrane used. Properties of high Youngs modulus, high thermal stability and electrical conductivity, inertness and zero band gap made it biocompatible to fabricate Intracranial piezo-resistive pressure (ICP) sensor with membrane as graphene. COMSOL Multiphysics tool which is a finite element analysis (FEA) is deployed to optimize the dimensions and parameters for using graphene as a structural layer for pressure sensor diaphragm. A variability study of piezo resistors with three different meander shape are designed and simulated in COMSOL. The optimum design is further analyzed for three different type of pressure sensor specifications as conventional, with n-type dopant and graphene as a structural layer. The design with three meander resistance and graphene as a structural layer provides a strain induced of 0.14 with the pressure input of 10 mmHg

Keywords: Piezo resistors, MEMS pressure sensor, Graphene

Paper ID	012074
Title	Effect of position and shape of electrode on resonant frequency of an artificial epithelium membrane for frequency selectivity
Authors	Sudha R Karbari, Suneel Sankanatti, Uttara Kumari M and Shireesha G

Abstract: Postoperative medical studies by various groups have shown the relevance of electrode position on the hearing outcome of the Cochlear Implant. There are various types of CI in market that are re-evaluated and changed for its functionality. Prior knowledge of the exact position of the electrode within the cochlea is an important parameter of study to improve the electrical stimulation of the hearing nerve for the implants. Similar studies are performed on the artificial epithelium membrane which involves restoring the function of outer and middle ear without bypassing their functionality and providing solution towards a self sustained implantable cochlea. Different shapes of electrodes are evaluated using various structures in dimensional analysis for improving the displacement and the electric stimulation calculated in terms of voltage. Five designs are modelled and optimized for improving the frequency selectivity for its resonance of an epithelium membrane to function as a biomimetic Epithelium membrane. Simulation studies are carried out using FEA analysis tool to introspect and evaluate the tonotopy of the epithelium membrane in terms of electrode shape and position.
Keywords: Nanotechnology, Cochlear Implant, Finite Element Analysis.

Paper ID	012075
Title	Optimization of wear and frictional parameters using IWO and PSO algorithms
Authors	Vajaram Venkata Reddy, Ravi Kumar Mandava, Deepak Kumar, Vijay Pachore, Vikas Kumar and V. Rama Koteswara Rao

Abstract: In the mechanical industries the tribological properties namely, wear rate and coefficient of friction are playing a significant role. Therefore, identifying the optimal parameters of wear and coefficient friction is a challenging task. To overcome this difficulty, in the present research work the authors are using various non-traditional algorithms such as Invasive Weed Optimization (IWO) and Particle Swarm Optimization (PSO) algorithms. The non-linear equation has been developed for T6-heat treated Al 7075/SiC/FA MMC's using response surface methodology. The three independent parameters as, load, sliding speed and sliding distance are considered to optimize the wear rate (WR) and coefficient of friction (COF). Finally, the performances of the established algorithms are compared in terms of their ability to develop the optimal solution.
Keywords: wear rate, coefficient of friction, heat-treated, IWO, PSO.

Paper ID	012076
Title	Creep behaviour analysis of brass bar on variable temperature
Authors	Md Danish Iqbal, Premanand S Chauhan, Avadesh K Sharma & Prem Prakash Pandit

Abstract: This paper presents the behaviour of Creep of Brass bar at different temperatures i.e. 300oC, 500oC and 600oC. It is necessary to perceive the behaviour of creep of Brass bar at different temperature conditions because this copper and its alloy are used in several high temperature applications. Results indicate that temperature has significant effect on the rate of deformation and life of component.
Keywords: Creep deformation, Brass, Creep at different temperature conditions.

Paper ID	012077
Title	Design optimisation of air filters using ANSYS fluent
Authors	Sandeep Agrawal, Premanand S Chauhan and Prem Prakash Pandit

Abstract: This paper is based on the current status of research and development in the high performance air filters segment. This can be done by choosing an appropriate filter and operating it under optimized conditions. The present paper details the applicability of filters used in conjunction with metal screen for the purpose of classifying aerosol. In this paper, the analysis on applicability of centrifugal force for achieving enhanced collection efficiency without increasing the pressure drop has also been done. This paper endorses the proposition that the quality of air filters can be improved remarkably and suggests a methodology for achieving the same. The Hepa filter can capture with extraordinary efficiency of 0.01 x10-9 meter sized particles. The size of the Corona Virus Covid-19 is 125 nm. The preliminary study shows that covid-19 can become aerosolized and can remain in the air for hours. After analysis, the flow rate has been increased from an initial value of 21 E 4 m3 /s (thickness 0.15 mm) to the optimized value of 92E4 m3 /s (thickness 0.91 mm) which is a significant increase of 338% i.e. 3.38 times from initial value. For optimizing the material porosity, it has been found that the filter shows the maximum performance at a porosity value of 0.95.
Keywords: Aerosol Classification, Air Filtration, Measurement, Nanofiber Filter, Quality Factor.

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