

# MACHINEDGE

A NEWSLETTER PUBLISHED BY DEPARTMENT OF MECHANICAL ENGINEERING, CMRIT

## QUICK HIGHLIGHTS

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**6**

**INDUSTRY  
CONNECT**

**6+**

**JOURNAL  
PUBLICATIONS**

**7**

**CLUB  
ACTIVITIES**

## Message from Principal

MachinEdge reflects the passion of the students and faculty of Department of Mechanical Engineering by elaborating on various curricular and co –curricular activities and reflects upon their various achievements. This helps in the overall development of our students. I am delighted to present the seventh edition of MachinEdge and would like to take this opportunity to thank the Editorial Team, faculty, trustees and all the other contributors of this edition of MachinEdge.

**-Dr. Sanjay Jain**

## Message from HOD

Greetings from the department of Mechanical Engineering, CMR Institute of Technology, Bengaluru. With close to ten years of its existence, the department has evinced continuous and successful growth in terms of adaptation and gaining competency in handling the new enhanced B.E. curriculum; in initiating new research avenues out of the two centers of excellences coming under its folds; and in its efforts to boost innovation and entrepreneurship activities primarily driven by the students. The department has done well through publication of research articles in international journals of repute, and bagging a funding for research (approximately 34 Lakhs) from the prestigious Naval Research Board, DRDO, Ministry of Defense has helped us to maintain and modernize our research infrastructure.

As always, our faculty have walked an extra mile by extending every possible academic assistance to students to ensure that each student emerges with flying colors in the forthcoming VTU exams. The mentors have done well in motivating their mentees in excelling in their studies, mini-projects and in various club and sport activities.

Come July, the department is excited about hosting the forthcoming faculty development program in Additive Manufacturing, which is fully sponsored by AICTE, New Delhi. This event will enable fruitful interaction between scientists from research laboratories and institutes; the user community of this novel manufacturing method; and the faculty participants hailing from all over India.

**-Dr. Ramachandran S**

## 1.

## Industry Connect

## NATIONAL ONLINE CONNECT

Conducted at	Type of training	Topic	Resource person	Resource person and designation	Start Date	End date	Duration
College level	Training Program	Metallography: Process and application	Inhouse Source	Dr. Bijayani Panda, Shreyas P, Harisha P, Puneeth kumar & ArunKumar	30/11/20	6/12/20	6 days
College level	Webinar	Introduction to the World of Fascinating Metallurgy & Materials Science	Tatasteel, Jamshedpur	Dr. Abhijeet Premkumar Moon Principal researcher	26/12/20	26/12/20	2 hours
College level	Training Program	Introduction to Finite Element Method	Inhouse source	Dr. Vijayananda Kaup, Mr. Chethan Kumar G, Mr. Prashant Hatti, Mr. Manikandan H, Mr Venkatesh Naik and Mr. Maharudresh A C	28/12/20	31/12/20	4 days

## OFFLINE CONNECT

<b>Type of event</b>	<b>Event Title</b>	<b>Place of event</b>	<b>Faculty</b>	<b>Date</b>
Workshop	NEP2020	CMRIT	Harish P	28/09/20
Workshop	NEP2020	CMRIT	Dr. Rajendraprasad Reddy	28/09/20
FDP	3D Printing and Design	UVCE	Srinivas Reddy M	FDP

# 2.

## Journal Publication

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**Title:** Study of mechanical characteristics of stir cast AA7050-B4C metal matrix ceramic composites.

**Faculty Participated:** Srinivas Reddy M

**Publisher Name:** Science Direct

**Date:** August 2020

**Abstract:** The AA7050 is one of the few alloys of aluminium which is used in almost all alloy related products in defense and aviation sector. Boron carbide (B4C) is relatively cheap, light weight, chemically stable material and has been known to be used in MMC applications. This study uses systematic stir casting of B4C as ceramic in AA7050. The alloy of interest was heated to molten state, further, modified technique for preparation of metal matrix composite was used, where in the B4C ceramic is added to the generated vortex and subsequently stirred for additional 3–4 min before casting to the appropriate structures and shapes for the mechanical studies. The B4C percentage are 2, 4, 6 and 8% (w/w) and the parameters studied are tensile strength (ASTME8-82), hardness (ASTM E10), density, compression, apart from the typical optical and SEM studies. The results indicate that resultant uniform composites of AA7050-B4C have 20–50% higher Brinell hardness, 20–50% higher ultimate tensile strength and yield strength as the ceramic percentage is increased. This result is significant, not common for the MMC of AA7050 and offers new insights into the extensive use of zinc rich aluminium alloys. The increase in performance of AA7050-B4C composite with increase in B4C percentage is an indication of uniformity of the composite. The linear relation between the mechanical parameter and the percentage of B4C is unique.

**Title:** Application of Automation strategies to prevent failure in mechatronic system

**Faculty Participated:** Chidananda R S

**Publisher Name:** Materials Today Proceedings

**Date:** August 2020

**Abstract:** The highly developing trends and technology in the automation industry focuses to improve productivity by automation. Though automation typically provides considerable advantages over cost saving, enhanced productivity and quality improvement; the issue of maintenance of the instruments cannot leave as untraceable. In this work, the proposed methodology predicts the failure well in advance with the alert message and also mentions the sensor identity which is critical and prone to failure by crossing the threshold value. This is achieved by rigorous data analysis using machine learning algorithms. Further on, the real-time data is considered to validate the proposed system and discusses promising results gained from applying the detailed approach in this scope.

**Title:** Effect of electrical resistance on ramp rate in cold end portion of SiC heating elements.

**Faculty Participated:** Dr. Shivanna D M

**Publisher Name:** Materials Today Proceedings

**Date:** August 2020

**Abstract:** In the present work silicon carbide is used in electrical resistance heating elements because of its high hardness, corrosion resistance, abrasion and high thermal conductivity. This material exhibits outstanding properties at high temperatures up to 1550 °C, in oxidizing or 1250 °C reducing atmosphere condition; the creep and strength is very high when compared to other materials. Silicon carbide heating element consists of a hot zone with a cold end. A range of sintered cold end portion of silicon carbide heating elements are prepared and analyzed. The results indicate that the push rate influenced the electrical resistance of the cold end portion of heating element and saving of energy consumption with increase of production rate.

**Title:** Integrated system of flat plate collector and Scheffler solar concentrator for enhancing thermal efficiency and steam generation rate

**Faculty Participated:** Dr. S Ramachandran

**Publisher Name:** Taylor and Francis

**Date:** August 2020

**Abstract:** Scheffler concentrators are used for heating water and producing steam. Flat plate collectors are normally used for low-temperature water heating. In this research work, the performances of a flat plate collector and a Scheffler solar concentrator were studied individually. After careful study of the results, an integrated system was developed to enhance the efficiency. Also, the experimental results were checked and validated through CFD. Flat plate collector shows higher efficiency in heating water up to 50~60°C and hence this feature is used for pre-heating the water fed to the Scheffler concentrator. As a result, Scheffler concentrator's thermal efficiency is improved significantly by about 6%. The steam generation rate of integrated system is also increased when compared to that of individual Scheffler concentrator. This study uses experimental works along with numerical methods to substantiate the results providing a good visualisation of the receiver's performance.

**Title:** Studies on Scheffler solar concentrator to optimise thermal efficiency

**Faculty Participated:** Dr. S Ramachandran

**Publisher Name:** Taylor and Francis

**Date:** August 2020

**Abstract:** Parametric analysis of Scheffler solar concentrator system is performed for improvement in thermal efficiency. A Scheffler concentrator of size 2.7 m<sup>2</sup> has been used for experimentation. Cylindrical and conical shape receivers each with 8-liter capacity was used for experimentation which serve a dual purpose of absorber as well as steam storage device. The thermal efficiencies with different receivers were calculated on the basis of parameters like shape of receiver, initial heating of inlet water, tilting angle of receiver and receiver with the glass cover for steam pressures up to 3 bars. Cylindrical receiver has the maximum efficiency of 56.64% in case of initial heating of water (50°C) and conical receiver has the maximum efficiency of 76.04% in case of tilting position of receiver (45°) at 1 bar. Response surface method was used to optimise the thermal efficiency of receiver. A general mathematical model for obtaining thermal efficiency has been developed for both types of receivers in terms of incident average solar radiation and mass flow rate of steam. The optimum predicted value of thermal efficiency is calculated from the general mathematical model and there is a good agreement found between the experimental and predicted results.

**Title:** Quantitative analysis of surface treatment to enhance surface finish and mechanical characteristics of ABS parts

**Faculty Participated:** Dr Sagar M Baligheid, Dr. Vijayananda Kaup, Mr. A C Maharudresh, Mr. Chetan Kumar G

**Publisher Name:** Springer publications

**Date:** August 2020

**Abstract:** Lack of surface integrity and porosity are the key factors limiting the growth of fused deposition modelling (FDM) method. The method requires an efficient post processing technique which is consistent, controllable and predictable to improve surface finish without affecting geometrical and mechanical properties. This work aims to setup a novel method to treat FDM parts to improve surface quality as well as heat absorption, which in turn makes it suitable for high temperature applications. In this process, Acrylonitrile Butadiene Styrene (ABS) parts are treated with montmorillonite nanoclay via acetone bathing. The parameters like layer thickness, nanoclay content and immersion time were considered for the investigation. The roughness is measured based on the deviation from the least square plane fixed to the computed surface topography data sets, which allows to investigate the influence of smoothing parameters. Further, parts have been investigated for thermal and mechanical properties to predict optimal smoothing parameters. Results showed the proposed surface treatment method could effectively reduce the roughness of the ABS parts. In addition, nanoclay coating showed remarkable effect on the ultimate tensile strength (UTS), reflection of heat radiation resulting in the reduction of heat absorption.

**Title:** Structural Analysis of a Cascaded Parabolic Solar Collector

**Faculty Participated:** Dr. S Ramachandran

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** In the current energy crisis, fuels are draining at an alarming rate, there is a pressing demand to develop cost-efficient alternate energy sources. Solar energy is available in abundance, however conventional solar systems are less efficient and expensive. Hence there is a need to harness solar energy in a more efficiently and economically manner. The present work deals with the structural analysis of a cascaded parabolic solar collector. The system will be an integrated structure balancing the overall weight of the parabolic trough with a glass tube absorber through which water flows. The proposed system consists of three parabolic solar collectors connected in parallel to enhance the thermal efficiency. The structural analysis plays a key role to evaluate the external and internal stresses acting on the proposed structure, along with the different forces acting on it, which will help in proper and efficient functioning of the system. The analysis was carried out using ANSYS 16 with tetrahedral mesh so that mesh elements can easily fit into system's complex structural geometry. The software provides real time simulation of the structure under different loading conditions, which gives stress and strain at each predefined mesh. The scoping method used in this analysis is 'geometry selection', in which a total of 5091 element selection were made, and number of nodes and elements used for this structure is 193709 and 118420 respectively. After the completion of meshing, the results such as equivalent elastic strain, elastic strain intensity, equivalent von Mises stress, maximum shear elastic strain, normal stress, normal elastic strain, maximum shear stress, total deformation, stress intensity of each component is obtained and evaluated. This analysis created a platform to compare and evaluate loads of different components, which helps to reduce the minor and major errors occur during the initial design, in order to obtain a highly stable and reliable structure. The structure is designed to withstand a load of 400 kg which includes the force exerted by the wind.

**Title:** Thermal Analysis on A Cascaded Solar Collector Using Nanofluid

**Faculty Participated:** Dr. S Ramachandran

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** In the present environment, solar energy is one of the vital forms of renewable energy available free of cost. Solar radiation can be harvested and converted as a useful form of energy. Systems are already available for the generation of thermal energy by concentrating solar energy using reflectors. Hence in the present work, to augment the thermal efficiency of the system, a cascaded solar collector with automatic tracking system is fabricated. In this, nano fluids Aluminium Oxide ( $Al_2O_3$ ) and Copper Oxide (CuO) are used to raise the thermal energy of the system. The proposed system is a unique technique to harness the maximum solar radiation. A cascaded parabolic solar trough collector with single axis automatic tracking system along with quartz tube receiver was fabricated. The single axis automatic tracking system tracks the sun, from east to west direction. The quartz tube receiver is fixed at the focal point of the parabolic trough through which heat transfer fluid flows. At first, experiment was conducted using water as the heat transfer fluid. The experiment was then repeated with Aluminium Oxide nano fluid. From the literatures, it is found that Copper Oxide has high thermal conductivity, based on volume concentration and particle size, compared to Aluminium Oxide and water. Subsequently, Copper Oxide nano fluid was prepared with suitable volume fraction and adequate base fluid proportion and the experiment was conducted using this and the results were compared. It is observed that the Copper Oxide nano fluid gives higher thermal output than Aluminium Oxide nano fluid and water.

**Title:** Performance of emission characteristics in CI engine using pig fat oil biodiesel

**Faculty Participated:** Dr. Arunkumar T

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** The present research would explore the use of biodiesel derived from pig fat oil for the analysis of the CI engine. In this case, pig fat was harvested for oil and used during the manufacturing process of biodiesel, called transesterification. The oil is stored. After the test, various biodiesel blends such as B10, B15, B20, B25 and B30 are tested under various load conditions, like 25%, 50%, 75% and 100% for the engine. The performance, combustion and emission characteristics of the engine are therefore evaluated briefly. Studies should be checked to see if the use of Pig fat biodiesel to substitute diesel fuel without engine alteration is appropriate.

**Title:** Investigation on blending higher alcohol with diesel in a direct injection compression ignition engine

**Faculty Participated:** Dr. Arunkumar T

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** The present investigation attempts to obtain simultaneous reduction of emission by means of combustion of minimum exhaust gas recirculation and diesel fuel reformulation to enable a moderately premixed lower temperature combustion style in Direct Injection C.I engine. Three higher alcohol/diesel combinations n-butanol, n-propanol, n-pentanol is 40% blended with diesel is prepared and tested under zero to high load. The same three blends are also investigated under the combination of exhaust gas recirculation rates (20%) at zero to high loads. The act as well as emissions characteristic of the engine are observed. The output indicates that blended diesel gives a longer ignition delay. The maximum pressure and maximum premixed heat release rate than diesel. Higher alcohol has fine lenience and best control of NO<sub>x</sub>, HC trade-off when compare to diesel. At 20% of EGR higher alcohol presented even ore reduction of NO<sub>x</sub>, HC emission in diesel blend but a small drop in performance as compared with normal diesel. It was observed that blended diesel presented best dominance in emission characteristics than diesel. The combination of lower exhaust gas recirculation and higher alcohol/diesel blend can obtain partially low temperature combustion and decrease NO<sub>x</sub>, HC and smoke emissions instantaneously.

**Title:** Influence of injection pressure on the performance of diesel engine using high performance fuel blend

**Faculty Participated:** Dr. Arunkumar T

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** In the present study, the influence of fuel injection pressure on the performance, combustion and emission characteristics of a 4 stroke CI engine is experimentally studied. Initially a fuel blend aiming to deliver high performance is prepared (5%Bio Diesel, 5% Rice bran oil, 40% Pentanol, and 50% Diesel). The prepared blend is tested for its properties according to American Society for Testing and Materials (ASTM) standards. The engine study was conducted by having 4 different kinds of injection pressures namely Normal Pressure (200bar), Retarded Pressure (180bar), Advanced Pressures (220bar and 240bar). The Brake Thermal Efficiency (BTE) is improved upon increasing the injection pressure. As a penalty NO<sub>x</sub> emission were increased since higher injection pressures promoted better combustion. But the Specific Fuel Consumption (SFC) is less at advanced injection pressures. The CO<sub>2</sub> Hydrocarbon emissions and smoke opacity values were comparatively reduced on advancing the injection pressure. The prepared blend can be used in a CI engine by advancing the injection pressures for improving the performance and combustion characteristics.

**Title:** Effect of injection pressure on the performance of diesel engine fuelled with pig fat oil biodiesel

**Faculty Participated:** Dr. Arunkumar T

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** Animal fats are being explored for preparing bio fuel blends. In the present work pork fat oil is converted into bio diesel. B20 blend of this with the diesel is prepared and tested for its performance. The influence of injection pressure of the engine for handling this blend is investigated. The test conducted on a four-stroke single cylinder CI engine. Four types of injection pressures were used for running the engine. The brake thermal efficiency (BTE) shows improved values on increasing the injection pressure up to 220 bar, but at 240 bar the BTE values are not up to the mark. BSFC and NOx emission values are not showing much difference between the injection pressures. Hydrocarbon emissions were reduced on increasing injection pressures. Combustion parameters for this engine conditions are all of similar trend. Overall, it can be included that the B20 blend of pork fat biodiesel can be used in CI engine with slight increase in injection pressure for better performance.

**Title:** Study on mechanical properties of aluminium 6061 / SiC composite by single and double stir casting process

**Faculty Participated:** Dr. Arunkumar T

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** Herein, Aluminium 6061 with various weight percentage (1 %, 3 % and 5 %) of Silicon Carbide (SiC-40nm), composite was fabricated by single stir casting (single SC) and double stir casting (double SC) process. Besides, the mechanical properties like hardness, ultimate tensile strength and yield strength of the prepared composites were used to compared the effects of single SC and double SC process. Completely, these properties were enhanced with increment of the reinforcement upto 3%, and then decreased due heterogeneous distribution/ agglomeration. In addition, both processed samples of optimum level of reinforcement (3 % of SiC) morphology and quantitative analysis was carried out. Overall, the double SC improved the nano particle distribution and mechanical properties than single SC process.

**Title:** Measuring thermal conductivity, viscosity depending on temperature silicon carbide  
- Therminol 55 nanofluids

**Faculty Participated:** Dr. Arunkumar T

**Publisher Name:** AIP Conference Proceedings

**Date:** December 2020

**Abstract:** This work is experimentally testing a combination of thermal conductivity and viscosity characteristics to achieve optimal heat transfer utilizing Silicon Carbide (SiC) Therminol 55 as Nanofluid. Recent experiments have shown that Nano-fluids have outstanding properties that render them efficient in many thermal transmission applications in comparison to basic fluids. SiC-Therminol 55 Nano-fluid is synthesized at varying amounts (0.1 per cent to 0.3 per cent) by the production of SiC Nano-Particles of length (80 nm) in therminol 55. Temperature and viscosity were calculated using kd2 Analyzer and Fenske Viscometer at a temperature range. The experimental effect, demonstrated by the highest thermal conductivity, raises volume concentration and decreases viscosity. At the end of the process, theoretical models are developed for the analysis of the propensity of the Nanofluid to well-established H-C models.

**Title:** Investigating the effect of heat treatment on B4C reinforced aluminum metal matrix composites

**Faculty Participated:** Shashank Dubey

**Publisher Name:** Elsevier

**Date:** December 2020

**Abstract:** The present work focuses on investigation of tensile and compressive strengths of AA7050-B4C composites before heat treatment (as-cast) and post heat treatment. Composites with 2, 4, 6 and 8 wt% of B4C were prepared using bottom pouring stir-casting furnace. Microstructural analysis done using EDS and SEM results affirmed that the B4C particulates were homogeneously scattered in the alloy matrix. Solution heat treatment was carried out on cast samples at 530 °C for a period of 2 h. After solution, T6 heat treatment (Artificial Ageing) was performed on the samples at 180 °C for a period of 8 h. Mechanical strength properties- yield strength, ultimate tensile strength and compression strength, were determined according to ASTM standards.

# 3.

## Club Activities

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### "Automation Quiz"

Date:02-09-2020

This automation quiz was conducted to make the best use of time and students' pre-requisite knowledge in their respective branches. Students from the 3rd, 5th and the 7th semesters of various departments attended the event. 88 students participated in the event. It kicked-off at 4:00 pm and the students began solving the various questions the quiz had to offer. The competition's main objective was to educate the students and let them realize the various skill sets that one ought to possess for them to clear such quizzes and competitive exams. Students soon realized the difficulty in the quiz. The co-ordinators had prepared a very challenging and interesting quiz that kept the participants focused.

The event successfully concluded at 5:00 pm. The students utilized their time in an extremely efficient manner and completed the quiz on time.

Vignesh Ramakrishnan of the 7th Semester Mechanical Branch topped the quiz by scoring a phenomenal 95% on the difficult quiz.

# "Think Mechanical"

Club: SME

Date: 08-09-2020

After discovering the interest of all the branches in the "Think Mechanical" event organized exclusively for Mechanical, the SME club decided to open the event for all the other branches and conduct it on the 8th of September, 2020.

The Think Mechanical Talk, held on the 8th of September had participants from all batches of B.E coming forward and showcasing their brilliant orating skills, wherein the candidate picked a topic, spoke for the given time, 2 minutes, to organize their thoughts and were allotted an additional 2 minutes to speak on the chosen topic.

THINK MECHANICAL IS AN OPEN PLAYGROUND FOR ENGINEERS TO QUESTION

IDEAS, MAKE NEW ONES AND HAVE A DISCUSSION ABOUT ANYTHING AND

EVERYTHING A MECHANICAL ENGINEER WOULD FACE IN REAL WORLD SITUATION.

# "Debate V 1.0"

Date: 30-09-2020

The main purpose of this event was to understand the various types of drive systems available in the market for automobile Industry.

Students were asked to debate on the topic 'Conventional IC engines Vs Electric Drive systems'.

About 40 students participated in the event. Two groups were formed based on their choice and asked debate abiding the general debate rules. Students were enthusiastic and lot of facts that were not commonly known were also thoroughly discussed.

# “Design for Future”

Date: 05-10-2020 to 08-10-2020

The main purpose of this event was to spark an interest in students to develop designs of a gadget/components/equipments which is innovative as well as futuristic.

Around 30 students participated in the event. They had inventive ideas that made the event successful.

# “Career Path Planning”

Date: 12-10-2020 to 15-10-2020

The main purpose of this event was to identify the ambitions of students with respect to their dream job. Around 25 students participated in the event. Students were able to put their thoughts in words and discuss them with respect to the nature of work, types of job profiles and also regarding the annual pay.

This activity helped students visualize and understand the types of job profiles available and the different skill sets required for those types of jobs.

# “Mad-Adverts 1.0”

Date: 15-08-2020

The main aim was to provide students with an exposure to think innovatively and creatively to design!

Students had to design a poster which contains or portrays the technical content.

They could take any product that interested them and create a design and submit it.

# “Material Science Quiz”

Date: 22-10-2020

This quiz required students to make the best use of time and the pre-requisite knowledge of the subject material science. Students from the 3rd, 5th and the 7th semester of various departments attended the event.

The event was attended by a total of 88 students in total. It started at 4:00 pm and the students began solving the various questions the quiz had to offer. The competition's main objective was to educate the students and let them realize the various skill sets that one ought to possess for them to clear such quizzes and competitive exams.

The event was successfully concluded at 5pm. The students utilized their time in an extremely efficient manner and completed the quiz in time.

Vishnu S of the 5th Semester Mechanical Branch topped the quiz by scoring a phenomenal 95% on the difficult quiz.

# Editorial Committee

## **Students:**

Deeptha Sabarish: 1cr17me023

“Happiness can be found in the darkest of places. As long as one remembers to seek out the light. “

-Albus Dumbledore

Dhruva K Gowda: 1CR18ME024

"Shadows have been a light upon our faces"

Hruthik S Mushigeri: 1CR18ME029

“The higher we soar, the smaller we appear to those who cannot fly.”

- Friedrich Nietzsche

Kurt Pinto: 1CR18ME033

“Ideas are far more powerful weapon than guns.”

-Joseph Stalin

Manoj Shivakumar, 1cr18me042

“Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful.”

-Herman Cain

## **Faculty:**

Dr. Vijayanand Kaup

Dr. Ramachandran S

Dr. Rajendra Prasad Reddy

Professor. Chidhananda. R. S

CMR Institute of Technology

Department of Mechanical Engineering