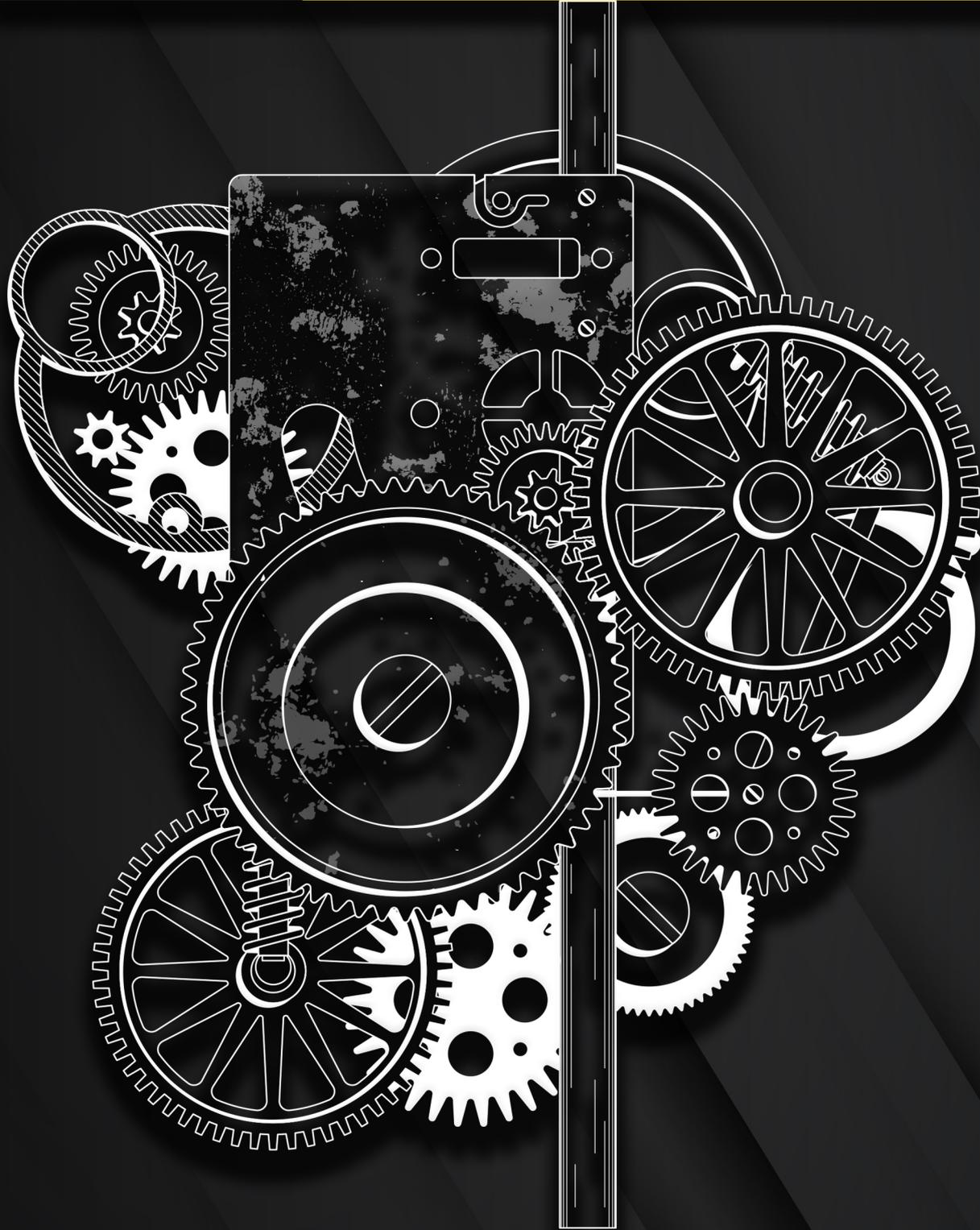
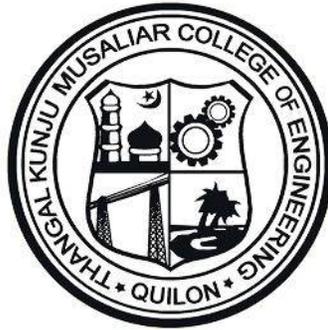


GREASE **NUT**

DEPT. OF MECHANICAL ENGINEERING



SEPTEMBER 2020



GREASE NUT



**MECHANICAL & PRODUCTION
ASSOCIATION**

**MECHANICAL & PRODUCTION ENGINEERING ASSOCIATION MAGAZINE 2019-20
TKM COLLEGE OF ENGINEERING, KOLLAM**

MESSAGE FROM THE PRINCIPAL

“It gives me great pleasure to bring out GREASE NUT 2020 from the Mechanical Department of our college. Times have changed and the digital age is upon us and yet, the power of ink still remains unparalleled. I strongly believe that this magazine will serve as a reminder to all the generations to come, about the glorious feats that our Mechanical Engineering students have achieved in this era. Having obtained laurels at not just the state levels but also in the national levels in various competitions, the documentation of all those achievements in this magazine will serve as a source of inspiration for the many generations who are yet to walk through the minarets.

Considering the predicament that we are all in due to the pandemic, this is indeed a truly testing time for each and every one of us and one where we should stay strong and stand together. Lets take this as an opportunity to catch up with time and a way to improve ourselves into the best of us.

Education and the learning process do not have to be confined to the four walls of a classroom and my sincere advice to all my students is to seek knowledge from as many sources as you can to mould yourselves to become better human beings.

We look forward to the coming academic year, with excitement, confidence, hope and utmost optimism.



Dr. T A Shahul Hameed
Principal

MESSAGE FROM THE HEAD OF THE DEPARTMENT

“I am quite delighted to learn about the forthcoming issue GREASE NUT. The magazine will provide a platform for students and faculty members to expand their technical knowledge, sharpen their literary ability and will also develop the talent of the students. No doubt this creative endeavour will bring out a collection of scientific and literary expressions with distinct individual signatures. I do appreciate and applaud the editorial team for their successful completion of this tedious yet daunting task of compiling the thoughts and ideas of our students and faculty into a meaningful and delightful visual fest GREASE NUT

Nurturing creativity and inspiring innovation are two of the critical elements of successful education, and a department magazine is the perfect combination of both. It harnesses the creative energies of the academic community and condenses the spirit of their inspired imagination in the most brilliant way possible.

At present, we are living through an unprecedented global situation with the COVID-19 crisis creating real uncertainty for all of us. As we move through this challenging time, I wish you and your loved ones good health and safety. As you work to fulfil your commitment to the college and society, I'd like to remind you to practice self-care.

More than ever, our society needs a generation that excels both in academic and humane skills. Besides improving your intellectual ability, the fragrance of knowledge should inculcate a sense of empathy and compassion in you. It enables you to contest and dispute against social injustices. It provides a voice to the voiceless.

I congratulate the team of students and the faculty for their dedicated and tireless effort in bringing out this magazine. I wish all a delightful reading experience.”



Dr. Mohamed Sajid N K
Head of the Department
Dept. of Mechanical Engineering

MESSAGE FROM THE
STAFF EDITOR

“We are very pleased to present the department magazine 'GREASE NUT' for the academic year 2019-20.

GREASE NUT acts as a platform for the students and faculty of our department to share their achievements and expertise. Let these achievements act as embers in others to ignite inspiration and motivation to bring glory to the department and college. I also hope that the technical expertise shared by faculty members and students help others to broaden their views on new and upcoming technologies.

I take this opportunity to thank all students and faculty members who have made a contribution towards the fruition of magazine.



Prof. Faraz P Junaid
Staff Editor

EDITORIAL

“As chief editor, I'm very much exhilarated to pen for this glorious magazine to appreciate the commendable efforts put forth by the team for it's splendid beginning. I wish this venture to be a flint to fire the enthusiasm of readers to many fold, exciting their minds in innovation and creativity. This pleasantly designed publication is a coming together of minds of all disciplines stimulating passion and vigour among students as well as faculties of Mechanical Department.

So here we are presenting, GREASE NUT 2020 the most awaited magazine of our department. This renders an insight to the innovations and hard work payed off by our students and faculties. This portrays that our students are at the helm of excellence and for that we will always be grateful to the meticulous support of our mentors.

I hereby express my considerable appreciation to all the editorial members and the authors who were kind enough to put forth their valuable time and effort for this creative endeavour without which this wouldn't have been a success. I'm glad to welcome all students to foster articles with bright concepts and innovative ideas in the upcoming issues of Grease Nut. I expect this tradition set forward by the 2020 batch will be carried through the following generations to come.”



Jishnu G Nair
Chief Editor

EDITORIAL TEAM



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CHIEF EDITOR



JOVIAL
ASSOCIATE EDITOR



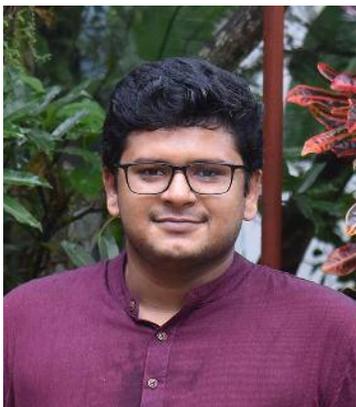
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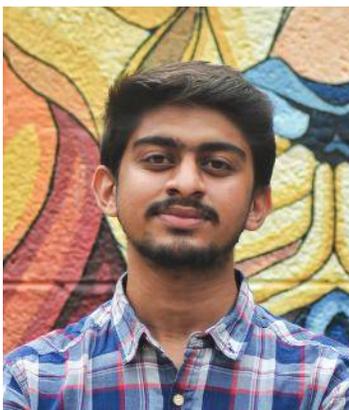
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GREASE NUT

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ABOUT **MECHANICAL ENGINEERING DEPARTMENT**

The Department of Mechanical Engineering has carved a niche for itself by offering the most competent instructional programmes to the students. In addition to the two Under Graduate Programmes (Mechanical Engineering and Production Engineering) the department is conducting a Post graduate programme in Industrial Refrigeration and Cryogenic Engineering.

The department is an approved research centre of University of Kerala and APJ Abdul Kalam Technological University and is a QIP (Quality Improvement Programme) centre approved by AICTE for PhD programme. The faculty of the department investigates a broad range of research in about a dozen thrust areas. Some of the specific areas include thermal management of electronic systems, nano materials and nano fluids, super conductivity, cryogenic heat transfer, heat and mass transfer in multiphase and single phase flows, food preservation, cryocoolers for space applications, thermoacoustics, computational combustion, fracture mechanics, micro structural studies, biomechanics, gas hydrates, composites, data analytics, solar cooling systems, energy storage, Micro Channel Heat Transfer, Biomass and Biofuel energy conversion.

Much of the research is conducted within the department, but many projects are carried out in collaboration with other reputed Institutions, Research and Development (R&D) organisations and laboratories in the country and abroad. The Department receives funding from agencies such as Ministry of Human Resource Development (MHRD), Department of Atomic Energy (DAE), Indian Space Research Organisation (ISRO) and other Government bodies. The faculty members render assistance to R&D organisations and industries through technical advice and consultancy services.



LOOKING
FOR AN
ANSWER?

Q&A FROM SOMNATH S

DIRECTOR VSSC

Q&A FROM SOMANATH. S, DIRECTOR, VSSC

SOMANATH S a proud alumni of TKM College of Engineering is an Indian aerospace engineer and rocket technologist. He is currently the Director of Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram. He also served as the Director of Liquid Propulsion Systems Centre (LPSC), Thiruvananthapuram. Somanath is known for his contributions to launch vehicle design, particularly in the areas of launch vehicle systems engineering, structural design, structural dynamics, and pyrotechnics.

1. What is it like sitting in the captain seat of a large organisation like VSSC?

Vikram Sarabhai Space Centre is the cradle of space technology. It is the mother centre that gave birth to the activities which later flourished to become the present ISRO centres of URSC, LPSC & IISu. There is a large pool of technologists and scientists of various disciplines working together to develop host of technologies and products including managing and leading the launch vehicle program of ISRO. As Director, there is considerable challenge in directing and co-ordinating a multi disciplinary team, enthuse them to take up new developments, handle administrative challenges of large number of projects, programs and budgets and technology management. I also have various organisational responsibilities as the Director of lead centre of ISRO. Even under all these tasks, the personal inspiration is in the opportunity to deal with new technologies, resolve and provide solutions to technical problems, to identify and develop new leadership and to be creative in identifying new areas of opportunities every day.



2. Looking back, how would you describe your journey to the pinnacle and what were your inspirations?

From the very day I joined ISRO, I had opportunity to work in core areas of technology, not fully realising the dimension of it at that time. I had the fortune to be with some inspirational leaders who always gave challenging responsibilities and opportunities to grow. I also grabbed what I can and worked very hard joyfully. There were also peers and seniors who supported and recognised the merit in me thus paving way for me to take up new assignments. So, my journey to the Director ship is due to building competence in various disciplines on a continuous basis, being humble and likable to most, demonstrate the willingness to work hard, take up responsibilities and produce results, and keeping high levels of integrity in work and personal relations.

3. From borrowing foreign technologies to developing the Indigenous GSLV MkIII, how far has India come in the Global Arena?

ISRO had co-operations with other leading space faring nations ever since its inception. This include the collaboration we had on satellite instructional television experiment (SITE during 1960s) which was using technologies from Russia, France and America during cold war time organised by Dr. Sarabhai. To leap-frog in the applications delivery we have to acquire some appropriate technologies. We had joint development of liquid

engine of VIKAS with SEP France, cryogenic engine collaboration with Russia etc are some of them. We may look for such opportunities in the future as well. When we are denied some technologies, we must develop indigenously, which we have pursued and produced great results. Indigenous content in our launch vehicle systems are as much as 90% today. Some of the critical systems we still depend on the foreign sources which include high end electronics devices and products, composite materials and certain alloying materials. We have to have concerted efforts to produce them in India in the long run.

In terms of the launch vehicle and satellite technologies, we are on par with any other nation having the same capability. The need to realise any systems is based on our national requirements which are at variance with theirs. We can claim that we have the capability to conceive any space technology mission, build any type of satellite and launch using our own launch vehicle from our land. This is not a small achievement. We are well recognised by other space agencies for our accomplishments especially for the frugal nature of our development cycle.

4. Even though Chandrayaan II failed to achieve a soft landing, it was hailed as a praise worthy effort by many Space Agencies worldwide. What did we learn from this mission and how will it help us in the future missions?

Any failure teaches us great lessons, so is Chandrayaan-2. In the final leg of the mission where it had narrowly missed the landing attempt after travelling 4 lakh km to moon and orbiting around moon perfectly. Having an autonomous craft which has to take all decision under adverse conditions is the challenge we faced. The system cannot be tested fully in the moon-like environment prior to flight due to the limitations of testing in earth. The requirement of high precision in various measurements and ruggedness of software and algorithm is well understood through this mission. We will be improving the design ruggedness to take care of more parametric dispersions and increase rigor of testing in earth under as much a

moon simulated condition as possible to minimise risk next time. Still there is always a residual risk in such missions, which we have to factor when we take up such challenges.

5. How is the CE-20 Cryo Engine used in GSLV Mrk.III different to the conventional Cryogenic Engine?

The CE20 engine is approximately twice as powerful as the previous cryogenic engine (CUS) we used for GSLV. The thermodynamic cycle used in CE20 is gas generator cycle (GG) whereas the CUS engine is based on Staged combustion Cycle (SCC). The CE20 engine is gimballed in two planes using actuators to achieve pitch and yaw control whereas the CUS is a fixed engine and steering is achieved using two additional side mounted vernier engines which are gimballed. The turbo pump consisting of gas turbine and pumps for Oxygen and Hydrogen for CUS is in a single shaft, whereas for CE20 it is with independent turbine and pump assemblies for Hydrogen and Oxygen. The choices we made for the CE20 were based on the easiness of development and testing of a GG cycle rather than higher efficiency of a SCC engine.

6. What was the Achievements and Challenges faced in the Mars Orbiter Mission?

MOM, The Mars Orbiter Mission was a pinnacle of space mission we achieved. It is momentous being the successful mission of our country for its first attempt. It should be hailed that it was accomplished with a PSLV launcher having just enough payload capability and for producing great results such as complete map and mineralogical studies of Mars. The MOM outlived the expected life around Mars and still functional. The challenges faced include achieving a design of a craft under 1400kg with adequate propellant to carry out the trans-Mars injection and orbital capture at Mars, increasing the payload capability of PSLV through incremental improvements to meet the highest payload capability ever to a GTO like orbit, packing many useful payloads into MOM to do very useful

experiments and finally navigating the satellite through its long journey precisely, with a liquid engine performing after almost a year of sleep to reduce the velocity and capture into the orbit of Mars. All these were achieved through rigorous reviews, ground tests and critical managerial decisions involving a large group of technologists.

7. Future missions like Aditya L-1 and Gaganyaan would be a significant milestone for India, tell us about the future endeavours of ISRO

Future space missions planning of India is based on the need of this country in the coming years and impact it has to create in different sectors through space technology. The thrust is in applications development in different sectors including agriculture, weather and climate, natural resource planning, communications infrastructure, security, navigation etc. Spacecrafts building with all the new capabilities such as high through put communication, centimetre resolution imaging, increased revisit times, providing continuity of applications across different satellites etc are the thrust areas. For this, many satellites are to be built and launched, and launch vehicle capability to be increased in numbers, at reduced cost and improved capability. This is the thrust area of the organisation. While doing these primary tasks, we have to keep advanced technology development as well. Scientific missions and exploration are one of the outcomes of the space technology. Aditya-L1, Gaganyaan, Venus Mission, Mars Orbiter mission-2, Chandrayaan-3 etc are some of these efforts. These missions create the required technology challenges and developments that will take India to next levels of competence in this area and will also feed to the on-going programs with improved technology such as spacecraft autonomy, better sensors, higher reliability in launch vehicles etc.

8. How far is India away from putting a man on the moon?

We have plans to enable human space travel through the Gaganyaan program, which is progressing well. I am sure that we shall accomplish this capability

within a few years. However, there is no plan to put human on the moon at present. If the country wishes to accomplish such a feat at a later point in time, we should be able to do that. Being high cost and technology intensive endeavour, the decision for human flight to moon should be based on cost benefit of such a program, need and justification to sustain the program or just for demonstration, our financial resources and preference of other pressing needs of the country and finally a political will.

Enabling continued human space travel and exploring the universe using the tools of space technology should be one of the capabilities India should acquire if we ever have to become a developed country.

9. There is an increasing trend, that the talented youths of our nation prefer to migrate to other nations and work for them. What is your opinion on this brain-drain with respect to science and development in our country?

I am not too much concerned about the so called brain drain. Indians have been migrating to other parts of the world throughout the history our nation. If well-educated and professional Indians migrate we shall be making better impact in the world thus bringing wealth, prestige and strategic advantage. To bring back the professional Indians from the other countries to our educational institutions and industries by providing better environments should be our strategy. Tier-1 educational institutions such as IITs have been the source of this brain drain. But most of the Indian scientific and technology institutions are now being efficiently led by the scientist and engineers from the Tier-2 institutions, such as TKM college of engineering. We should focus on creating high quality of education and research environment in Tier-2 and 3 institutions, promote lateral movement of educators and industry professional across domains and push for creating business or product development through the process of education.

10. Can you share any fond memories of your life in TKM?

TKM College of Engineering shaped the professional in me. It provided avenues for leadership development and learning group tasks. I remember the fountain we created for the silver jubilee celebration exhibition (during 1985) and the manufacturing of the equipments for the fluid dynamics laboratory done by a team of five of my class mates. We were provided with funds of almost Rs. 1.5 lakhs by the management at that time. I still remember the furore of activities during the silver jubilee celebrations which lasted for a week with large number of programs and open house exhibition.

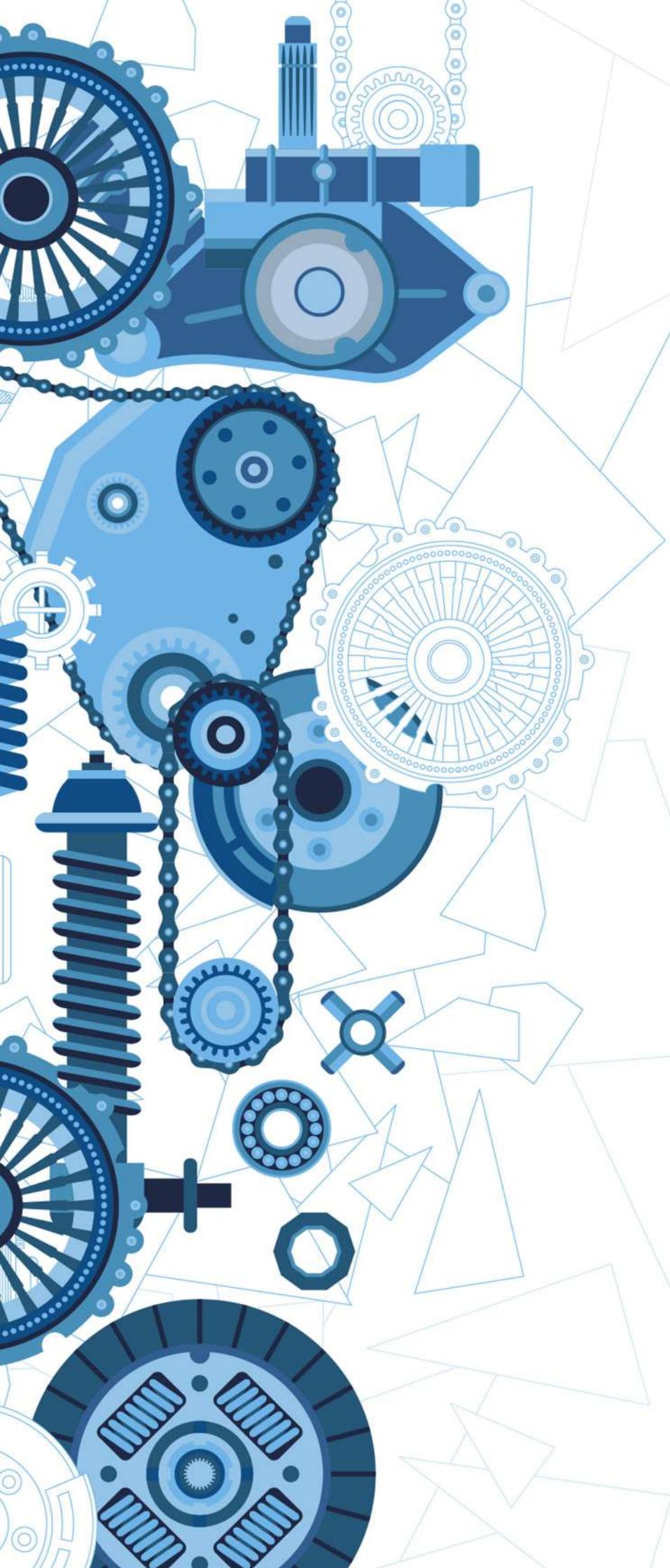
11. Any words for the future Aeronautical/Aerospace Engineering aspirants.

Studying undergraduate course in Aerospace engineering prepares one for taking up a career in the aeronautics and space technology domain. Take it up only if you are really passionate about it. It is not necessary to have an aerospace degree to do well in Space technology field. Aeronautical and Aerospace Engineering are specialised courses and not really a generic engineering course. I will recommend undergraduate engineering courses to be more general in nature and take up aerospace engineering as a specialised course in Masters. In aerospace engineering there are further specialisation such as propulsion, aerodynamics, control, structures and avionics which cover different domains. In ISRO, other space agencies and industries, the domains of design, manufacturing and management are well suited for any discipline of engineering. In ISRO we have engineers from all domains including civil, mechanical, electronics, electrical, computer science, chemical and production. Over time, and with institutional training, anybody can grow to develop expertise in this multi-disciplinary domain. In ISRO, post graduates in Aerospace engineering are only recruited and not graduates (except from IIST), whereas graduates in all other disciplines are recruited.

In Conclusion

I thank the editorial team for this opportunity. I wish to express my gratitude to my alma matter, its teachers and management for the life changing experience of my younger days. I pray all the best to the TKM College of Engineering to gain glory as a model educational and research institution and create future leaders for this country.

Ebin Isaac



TECHNICAL REPORTS



Biomass Briquetting Technologies

A Step towards Green Household Energy and New Start-up Opportunities in Kerala amid COVID-19 Pandemic Outbreak

The world is indeed enduring one of the worst phases of the era owing to the COVID-19 pandemic outbreak in 2019-2020. This ‘virus’ has perturbed the day-to-day activities of every single individual around the globe. What more? The Indian economy is drastically been affected due to the outbreak which has bound a spell on most of the domains, including the energy sector. The energy requirement in India for cooking purposes is mostly met by the open fire or ineffectual stoves that fill the households with smoke and greenhouse gases. Firewood serves the major proportion of cooking fuel among the rural communities. Around 25% of the urban population also depends on this fuel. Figure 1. illustrates a visualization of the approximate percentage of household fuels that is been used by the rural population as well as the urban population. Around 86.5% of the kitchens in rural areas are dependent solely on conventional energy sources and biomass sources that include firewood, crop residue (13%), cow dung cake (13%), coal, lignite, and charcoal. On the other hand, LPG and kerosene are utilized by only 11.47% and 0.7% population, respectively. Moving on to the urban population, the situation is quite diverse. LPG is the most commonly used fuel for cooking which contributes to 65% of the population, followed by biomass with 26.1% and kerosene with 7.5%. This was the normal scenario before the outbreak of the epidemic. However situations

have been diversified due to lockdown and subsequent global downturn which has affected a whole lot of people, especially labourers employed under daily wages. On this account, households which were already transitioned to greener cooking fuels like ethanol, LPG and electricity are now forced to move back to conventional polluting cooking techniques like firewood. This changeover could thoroughly be evident for inhabitants of both the populations. As a result, the quantity of greenhouse gases emitted from each household could increase to a wide extent, thereby contributing towards air pollution and increasing the susceptibility of the inhabitants to respiratory infections like pneumonia and asthma, which could consecutively lead to poorer outcomes after a COVID-19 infection. To sum up, it is high time to develop a green household fuel that can innovatively provide a cleaner solution to the problems induced by conventional fuels and at the same time be of economic importance to the financially unviable society

The Changing Face of India’s Power Sector

India is home to billions of people and has a vast economy. Hence the energy requirements of the country are equally high. According to statistics, India's peak power demand (met) was recorded at 170.17 GW on March 3, 2020 during the three-week period (till March 21, 2020) without COVID-19 impact on consumption. Meanwhile, India’s total generating capacity has reached 372 GW as on March 31, 2020, up from 358.6 GW during the same time last year. Out of this, 86.75 GW of the energy capacity comes from renewable energy sources, out

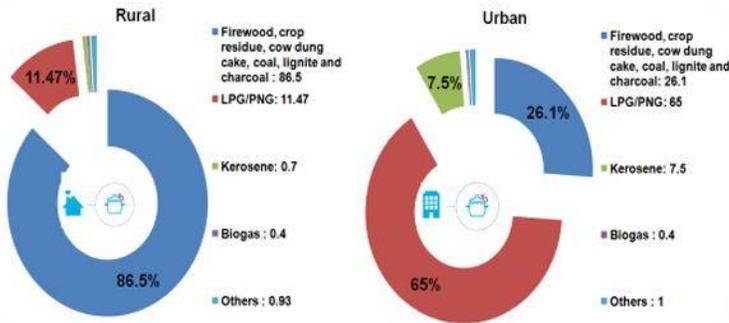


Fig. 1 Energy access in rural and urban areas (in percentages)
 [Source: Houses, Household Amenities and Assets Data 2001 - 2011 - Visualizing Through Maps by DR. C. Chandramouli]



Fig. 2 Photograph of burning of agricultural residues

of which solar and wind comprises 34.40 GW and 37.66 GW respectively. Biomass and small hydro power constitute 9.80 GW and 4.6 GW, respectively. The rest are met by non-renewable energy sources such as coal, petroleum, natural gas and nuclear energy. According to 2018 Climate scope report India ranked second among the emerging economies to lead to transition to clean energy. As a result, the country is on its way to increase its renewable energy capacity with an ambitious target of achieving 175 GW of clean energy capacity by 2022, including 100 GW solar and 60 GW of wind energy.

Moving on to the state of Kerala, the state generates power from four main sources- solar, hydel, thermal and wind. Of these, hydel and thermal power generations account for the considerable majority whereas wind and solar power generations make only marginal additions. The estimated potential of renewable power in Kerala as on 31-03-2019 is 9538 MW and the contribution from different renewable sources is summarized in Table 1.

Table 1: Estimated Potential of Renewable Power in Kerala as on 31/03/2019[Source: National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India, Energy Statistics Report 2020]
 Renewable Energy Sources Energy (in MW)

Renewable Energy Sources	Energy(inMW)
Wind power (@100m)	1700
Small Hydro Power	647
Biomass Power	1044
Waste to Energy	36
Solar Energy	6110
TOTAL	9538 MW
% Distribution in India	0.87%

Sneak Peek into Biomass Briquetting

India, being an agriculture-dependent economy, around 60% of the total land is attributed towards agricultural practices. This sector imparts around 17.4% towards the gross domestic product (GDP) and also renders employment and livelihoods to more than 48.9% of the country’s total population. Having a huge area contributed to agriculture, a substantial amount of crop- residues is been generated on and off the farms. Apart from this, a great deal of aquatic wastes is also being produced, which is either discarded in the water bodies itself, or thrown out to landfills. In India, biomass is available—in the form of waste from different sources such as agriculture, municipal, forest, or food processing industries minor share of these biomass residues is utilized for conventional purposes like fodder for animals, domestic fuel for cooking, construction material for rural housing, etc. The major share is being dumped to landfills or is directly burned. By doing so, it contributes to both land and air pollution respectively. Besides the problems caused due to transportation, handling, and storage of loose biomass, its direct burning in conventional grates is correlated with lower thermal efficiency and air pollution. The conversion efficiencies are as low as 40% with particulate emissions in the flue gases in excess of 3000 mg/Nm³. In addition, a large percentage of unburnt carbonaceous ash has to be disposed of. Hence, an alternative technique that is been employed worldwide for the systematized utilization

of agricultural and other biomass residues is their densification to produce briquettes. The technique of briquetting biomass residues tremendously enhances the volumetric calorific value, handling features, decreases the transportation costs, and contributes to a greener cooking fuel, which could be of potential use to the downturned economy.



Fig. 3 Photograph of Biomass

Biomass Briquetting Technology- A Closer Look

Briquettes composed of forestry and agricultural residues namely straw, bamboo sawdust, rice stalk, cotton stalk, ramie stalk, peanut husk, wood flour, etc. are categorized under biomass fuel briquettes. These are manufactured after various processing techniques like drying, crushing, mixing, moulding, compressing, etc. and ultimately into the fine form by means of briquetting machineries. At present, two main high-pressure technologies: ram or piston press and screw extrusion machines, are used for briquetting. The end product is the biomass briquette which is an economically affordable replacement for conventional and traditional fuel sources such as gasoline, gas, coal, firewood, etc. Moreover, they emit lower quantities of net greenhouse gases compared to conventional fuels, as the raw materials used for biomass briquette manufacturing have already been a part of the carbon cycle. Hence, biomass briquettes can be burnt clean, making them a stepping transition towards green household energy. Moisture content, volatile matter content, ash content, and fixed carbon are the parameters used to determine the combustion characteristics of the biomass briquettes. Table 2 compares the combustion

characteristics of vegetable market waste based briquettes developed at Energy Research Lab, TKM College of Engineering, Kollam with firewood and coal. In almost all biomasses, the amount of volatile matter is higher than in coal and comparable with that of firewood. Consequently, the fractional heat contribution of the volatile matter is more for biomass briquettes. This makes biomass briquettes a more reactive fuel than coal, giving a much faster combustion rate during the volatilization phase. Generally, a higher percentage of volatile matter is an indication that the ignition rate will be high.

Table 2 Proximate and heating value characteristics of vegetable market waste based briquettes and other energy sources

Parameter	Briquettes made from vegetable market waste and sawdust	Fire wood	Coal
Moisture content (%)	4.4	10-20	8-10
Volatile matter content (%)	83.2	75-80	20-35
Ash Content (%)	2.1	0.6-3	5-40
Fixed carbon (%)	10.3	20-25	51-53
Calorific Value (MJ/kg)	15.721	18.5 -21	2-35

Ash content was influenced by the quality of the raw material used. Biomass residues normally have much lower ash content (except for rice husk with 20% ash). Ash is the non-combustible component of a biomass, and the higher the fuel's ash content, the lower its calorific value. Ash is known to cause problems in combustion systems, notably because of formation of slag and deposition over the surface of the metals and its tendency to increase the rate of corrosion of the metal in the system. These are mainly for fuels such as coal and have proved to be of limited value for biomass briquettes. Biomass has a lower fixed carbon content, that makes it a highly reactive and better fuel. A high percentage of fixed carbon will enhance the heat value, but the fixed carbon

content, that makes it a highly reactive and better fuel. A high percentage of fixed carbon will enhance the heat value, but the fixed carbon content and the calorific value of biomass briquettes are generally lower than coal. So, the heating value is low when compared with coal; however, on the other side, the cost of briquettes is low compared with conventional coals.

Current Utilization of Biomass Briquettes

In developing countries like India, biomass briquettes are used as cooking fuels where other cooking fuels are not easily available. Precisely in Kerala, sawdust briquettes are been most commonly used. Nowadays, there has been a shift towards the use of briquettes in heating industrial boilers in order to produce electricity from steam. The briquettes are co fired with coal in order to create the heat supplied to the boiler. NPTC Ltd. has already started using briquettes for co-firing across all its coal-based thermal power stations in a bid to reduce greenhouse gas emissions and cut pollution. The utilization of briquette for co-firing has the potential to reduce emissions from coal-fuelled generation, without substantially increasing costs or infrastructure investments. The main application of biomass briquette in Kerala includes: its use as an efficient fuel in the dairy unit such as milma, agro-based firms for tea drying, tobacco curing and oil milling, etc., in poultry for heating of chicks and incubation purposes, for the firing of the furnaces in brick kilns and ceramic units.

Post Covid-19 Era will need more Engineers in Biomass Briquetting

The COVID-19 pandemic has tremendously encumbered several domains in India, most distinctly, the higher education sector which is an integral part of India's economic future. The outbreak has in fact thrown education all over the country in a loop. To add on, placements in India's top-rated engineering colleges are at a stake due to the ineluctable economic stagnation that is expected to take over. Most of the final year students are dismayed by the decision of

of most of the MNCs who have ceased to show interest in college placements and MNCs that have adjourned or dissolved the offers to the already hired students.

Deforestation regulation that has enforced curb on tree cutting and the increased cost of sawdust are forcing the briquetting industry to shift towards the greener biomass briquetting technique which is been utilized from agricultural and aquatic residues. The biomass briquetting technology can be efficiently made practical by Kerala's young generation of entrepreneurs who have the potential to develop innovative ideas into successful business ventures. The selection of suitable raw material resources for briquetting is the primary concern for such start-ups. Energy Research Center of TKM College of Engineering is providing a unique opportunity to perform proximate analysis, ultimate analysis and calorific value test, which are essential for selecting the suitable raw materials which are required for researches, start-up and innovators.

Compared with fossil fuel technologies, which are typically mechanized and capital intensive, the biomass briquetting industry is more labour intensive. Briquetting plants need humans to install them also require technicians for maintenance. This means that, on an average, more jobs opportunities are created for briquetting industry than from fossil fuels. Farmers and rural landowners can generate new sources of supplemental income by producing feed stocks for biomass briquetting. Thus, agro-aquatic waste-based briquette can perform dual functions; a method for waste disposal and a source of energy. This would be an ideal solution for the problems associated with conventional cooking fuels, thereby enabling a transition towards green household energy post COVID-19 era. In addition to the jobs directly created in the briquetting industry, growth in clean energy can create positive economic "ripple" effects.

Dr. Baiju V, Assistant Professor & Robin David, Research Scholar, Dept. of Mechanical Engineering



A Review on Cooling System of Tesla Model S

Why does an Electric Vehicle require cooling?

It is easier to picturize the need of a cooling system in a combustion vehicle as power is produced by controlled explosions. A 4 cylinder engine vehicle moving at a speed of 60 km/hr will produce nearly 4000 explosions per minute and all the developed heat need to be properly cooled for its optimum functioning and durability. However, when it comes to electric vehicles, one may wonder if cooling is that important. An electric vehicle, as you all know is powered by an electric motor. A battery supplies electricity to the Motor and there are many other power electronic devices such as inverter, regulator, control unit, etc that are used to control the power and torque produced by the motor. The motor, battery, and other power electronic devices produce a large amount of heat during their working. This heat will lower the efficiency of these components and will adversely impact their durability.

With many advancements made to this greener mode of transport, one of the biggest challenges of the designers is to keep the components in their optimum working temperature which will eventually lead to an increase in power, range and reliability. A battery generates heat while charging and discharging. In an electric vehicle the battery is constantly charged and discharged, as such the amount of heat produced is

very high. If high amount of power is required, the battery is discharged quickly, thereby producing large amount of heat. Batteries work based on the principle of a voltage differential, and at high temperatures, the electrons inside become excited which decreases the difference in voltage between the two sides of the battery. Because batteries are only manufactured to work between certain temperature extremes, they will stop working if there is no cooling system to keep it in a working range. On the other side, there is the motor. Motor develops heat due to losses. These losses are mainly core losses due to eddy current, stator winding losses due to electrical resistance and bearing heat generation due to friction. The high temperature causes the electrical resistance to rise thus, lowering the efficiency of the motor. If the heating continues, the magnets will lose their strength and the motor windings can melt therefore damaging the motor permanently.

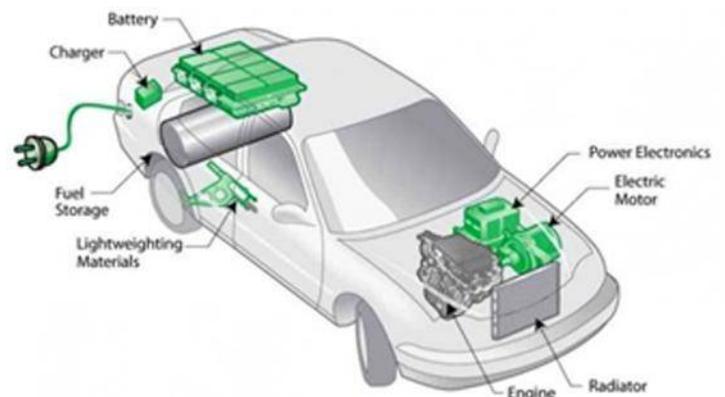


Figure 1. General layout of an Electric Vehicle

Automobile giants such as Tesla, Audi and BMW have been conducting many studies and researches to develop more effective cooling systems for their vehicles. This article will explain in detail on how Tesla, Inc manage to cool one of their most premier products, Model S.

Tesla Model S

Model S is an all electric all wheel drive sedan produced by Tesla, Inc. It was first introduced in June 2012. Since then it has undergone a number of updates till the current generation variant rolled out on March 2017. It is powered by a 260hp and 500hp motors at front and rear respectively producing a top speed of 250 km/hr. It can reach 100 km/hr. in just 2.28s and has an estimated range of 500 km in single charge.



Figure 2. Tesla Model S

A 100 kWh Lithium ion battery is used to provide electricity to the entire vehicle. Tesla claims that they have developed the most effective cooling system for Model S and offers 8 years warranty on the battery pack. The battery packs, controller units and motors are liquid cooled. A robust and reliable cooling system is required in this high-performance vehicle.

Liquid Cooling Model in Tesla Model S

In a general liquid cooling model, a liquid, known as coolant, having high heat absorbing capability is forced to flow over the components that need to be cooled. The coolant absorbs heat and is sent to radiator whereby it's cooled by forced convection. Some amount of coolant is cooled with the help of refrigerant in AC system. The coolant used in Model S is water-glycol.

General Layout:

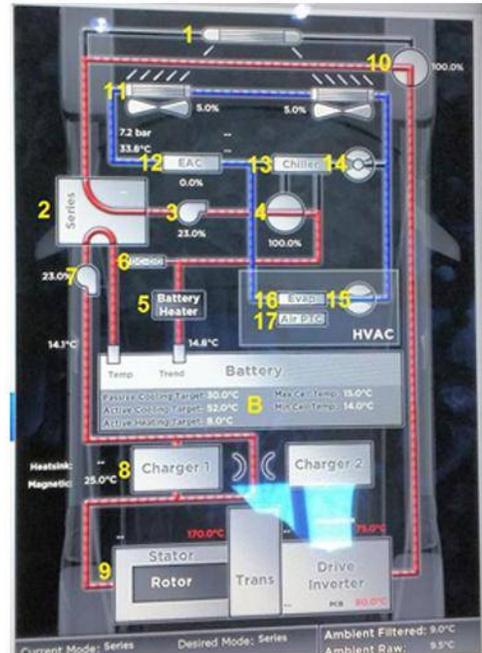


Figure 3. Image of onboard Diagnosis in Model S

- 1. Main coolant radiator:** This unit does not have a fan, the coolant is cooled by the incoming air when the vehicle is moving. The flow to this section can be bypassed coolant redirection valve (10)
- 2. Coolant circulation mode selector:** This device switches to either parallel – Flow from 1 to 7 and 3 to 6 or series – Flow from 1 to 3 and 6 to 7
- 3. 12V coolant pump:** To pump the coolant through the lines.
- 4. Adjustable coolant redirection valve:** This valve controls how much amount of coolant need to be send to the chiller to cool it with the help of refrigerant.
- 5. Coolant heater:** This is used to heat the coolant in order to heat the battery during cold conditions
- 6. DC-DC converter:** This device takes up small energy from the battery pack to charge the 12v battery and keep all 12v devices running. Produces small amount of heat which is cooled by flowing coolant

7. 12V Coolant Pump: To pump coolant through the lines.

8. On-board charger: This is where the vehicle is charged, it converts AC current from grid to DC current for battery.

9. Drivetrain: Houses the Motor and transmission, coolant flows through the stator and rotor to cool the motor.

10. Adjustable coolant redirection valve: Controls how much amount of coolant flows to radiator.

11. AC condenser: Condenses the refrigerant

12. Electric Air Conditioner Compressor: It is used to compress the refrigerant low pressure low temperature to high pressure high temperature.

13. Chiller: It is where the coolant exchanges heat with the refrigerant. It is the point of interaction between the refrigerant and coolant.

14. Chiller activation valve: A on/off valve that controls the interaction between refrigerant and coolant.

15. Cabin evaporator activation valve, 16. Cabin air evaporator and 17. Cabin air PTC heater element: These are the remaining parts of vehicles HVAC system that cools the cabin

Battery Cooling:

Controlling the temperature of Lithium ion battery pack is a balancing act. The performance of Lithium-Ion battery cells is greatly impacted by their temperature, they suffer from the Goldilocks effect, they do not perform well when too cold or too hot, which can lead to permanent and extreme damage of the cells or accelerated degradation. So in addition to cooling, heating of the cells may also be required at lower ambient temperatures to prevent damage during fast charging when the cells are too cold; this is because the internal resistance of the cells rises when

they are cold. Most lithium battery cells cannot be fast-charged when they are less than 5oC and cannot be charged at all when they are below 0oC. Lithium cells also begin to degrade quickly when their temperature is above 45oC.

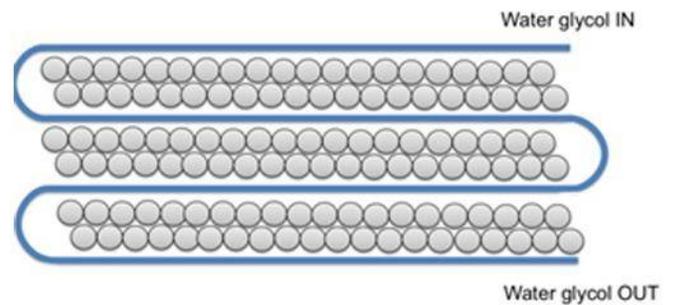


Figure 4. Model S Battery cooling

The water-glycol is pumped around the battery cells as shown in Figure 3. The coolant absorbs heat from the sides of the battery cells. This method is not as effective as the battery module design model used in Audi and therefore under extreme driving, the battery packs in Tesla gets overheated. This is why Tesla has limited the usage of 'Ludicrous Mode' to a certain number of times before the Limp mode kicks in and prevents the battery from further overheating and damaging.



Figure 5. Model S Battery Pack

Motor/Drivetrain Cooling:

In this cooling model, both rotor and stator are directly cooled by water-glycol. In detail, coolant manifold injection dissipates the heat of the stator core by means of the forced convection heat transfer with the coolant, and heat transfer via gravity-fed coolant and the rotating rotor makes the

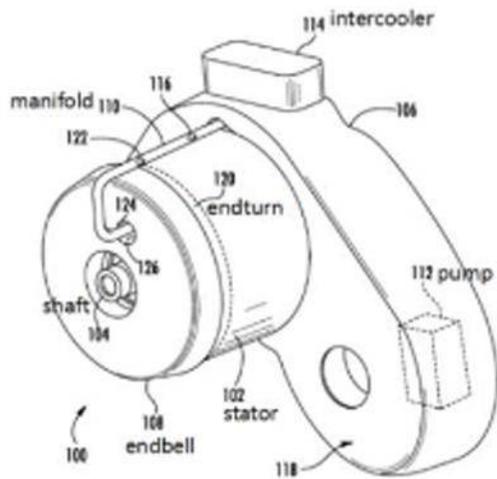


Figure 6. Motor Cooling in Tesla Model S

In this cooling model, both rotor and stator are directly cooled by water-glycol. In detail, coolant manifold injection dissipates the heat of the stator core by means of the forced convection heat transfer with the coolant, and heat transfer via gravity-fed coolant and the rotating rotor makes the stator winding cool. The rotor is cooled by heat transfer with the fluid via coolant manifold injection and gravity-fed coolant distribution of the trays. The cooling effect at the end parts of the rotor is relatively good, but the coolant cannot contact with the outer and inner surface of the rotor and thereby reduce the heat dissipation of the rotor. It causes insufficient cooling capacity under heavy load conditions. Since cooling uniformity cannot be achieved.



Figure 7. Tesla Model S

The top end performance of the motors is limited to few number of times to avoid damage. The limp mode reduces the power by a substantial amount and keeps temperature within the limits.

Conclusion

Model S is one of the most technologically advanced electric vehicles in the world. However, even with all these advancements, the performance of this vehicle is pegged back by its overheating issue. It is obvious that the cooling system in an electric vehicle requires further improvement. At present, the true performance of an electric vehicle is restricted due to ineffective cooling systems. Electric vehicles are predicted to completely replace combustion vehicles by 2050 as such the demand for performance, range, reliability will be ever increasing. All these parameters can only be improved if major components such as battery packs and motors are properly cooled and kept at optimum working temperature. Many innovative ideas are being developed and tested around the world by many companies. Hopefully, with success in these methods we will soon be hearing about more eco-friendly, reliable and longer range electric vehicles with performance that may exceed high performance combustion vehicles.

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CONCEPT FOR DEVELOPING A ROBUST TECHNIQUE TO NULLIFY NOISE FROM PULSED DOPPLER WEATHER RADAR SIGNALS.

The concept for developing a robust signal processing technique to nullify noise interference from pulsed doppler weather radar signals originally came from an experimental pilot study conducted on a method for separating Saturn emissions from Power-line interferences, which was successfully achieved recently. By applying the same method with some modification in a logic way, the algorithm and the method can be efficiently applied on pulsed doppler weather radars for effective measurements of atmospheric parameters, As the signal progress through the atmosphere at greater heights the noise will overtake the signal and eventually fade out the signals from the radar. To overcome these situations, various algorithms and methods are being used. The objective is to prove that the method used for separation of Saturn emissions from Powerline interferences can be applied to the pulsed Doppler weather radar. The methodology involves Maximum likelihood gradient search of Short Term Fourier Transformed signal. By processing the data block wise for time-frequency predominance, the original signals were retrieved using W-disjoint orthogonality principle. Here Modified Blind Source Component Separation which relies on an indigenous method is being utilized for the retrieval of the signals. It was noted that this

signal processing algorithm can be applied for the radar measurements. By following this methodology, similar to the separation of Saturn emission and Powerline interferences, a radar signal with noise can be separated out, giving more clarity to the radar signals at greater altitude. Results show that by modifying the algorithm and method, it can be effectively utilized for the pulsed Doppler weather radars for climate monitoring and other remote sensing applications.

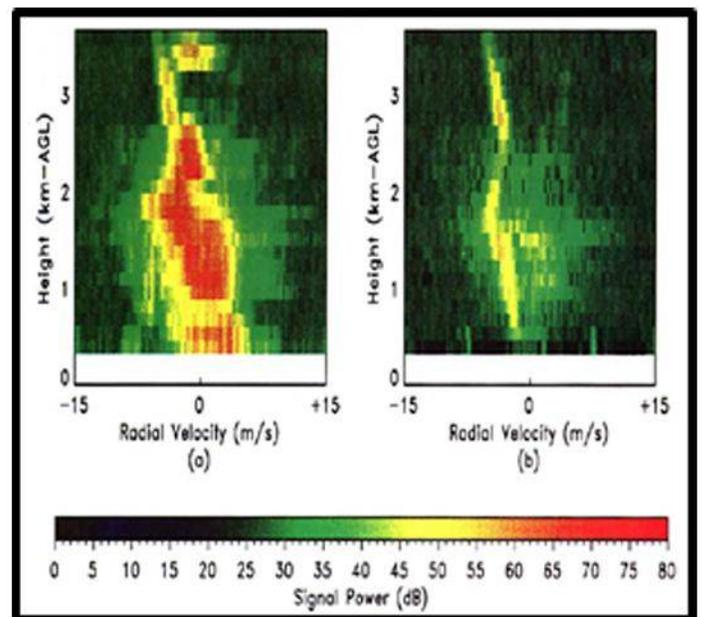


Fig (a). The complex radio spectrum obtained using the Cassini radio and plasma wave science instrument. (Courtesy NASA).

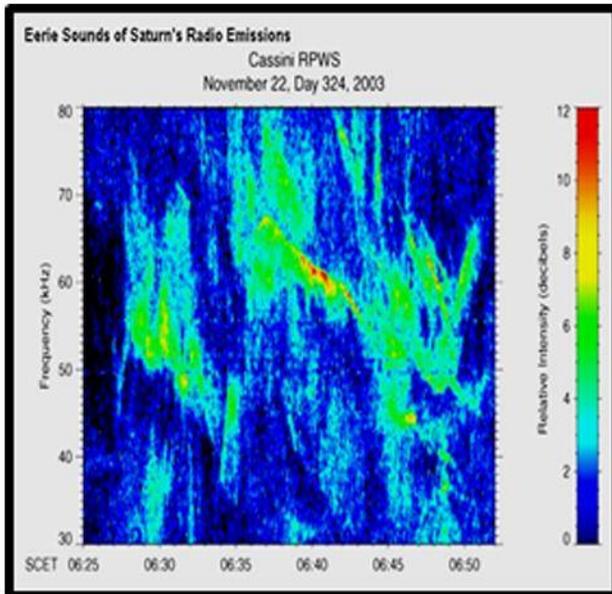


Fig (b). (a) Severe bird contamination, Background noise is green and the strongest bird signal is red. (b) Bird contamination is removed using statistical averaging method (Courtesy David A Merritt).

By processing the data block wise for time frequency predominance, the original signals were retrieved using W-disjoint orthogonality principle. The high resolution observations from Saturn signals, showed an amazing array of variations in frequency and time. For example the complex radio spectrum with rising and falling tones, shown in fig (a), which was very similar to Earth's aurora radio signals and false addition as amplitude which will appear as noise impressed on signal, with these extreme noises can saturate at receiver input causing the signals to be corrupted. In the case of Radar in operation, it faces the same dispute as the signal progresses with altitude, shown in fig (b). By utilizing the features of the modified blind source component separation method, independent components were separated out and had proved that the concept can be applied to signal processing in pulsed doppler weather radars. Independent components were recovered by taking Inverse Discrete Fourier Transform. A weight factor was established for updating data, the bit depth and sampling rate thus obtained were verified by comparing with the original data. The magnitude of the weight

factor determines whether the output needs up sampling or down sampling. Future scope of this new concept extends without any limit or border and is applicable in every field of science.

“Listen carefully, every whisper of our mother nature has a story to tell “

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FLIPPED CLASSROOM

A Solution for Teaching during Social Distancing Time and Beyond

Flipped classroom is emerging teaching-learning approach to make efficient use of class time. This article gives an introduction to the flipped classroom approach, how it can be implemented as well as the advantages and disadvantages while put into practice. The purpose of the article is to make both students and teachers in higher education understand the scope of flipped classroom in improving learner outcomes. Emphasis here is on the aspects of flipping the activities that was in the traditional classrooms. Some strategies for implementing flipped classroom are also suggested. The take away for the readers are the understanding of the concept, the basic procedures followed and the good practices for flipped classroom in higher education.

Why is it important?

In traditional classrooms it is difficult to ensure that the learning

outcomes are met by the students. This is majorly due to large class sizes with 60-80 students. Large number of students in a classroom leads to (i) difficulty in giving personalized attention (instead results in attention confined to a few active students), (ii) less 'think time' for weaker students (teacher has to go with the pace of a few active students) (iii) teacher can attend to the doubts of only a few students. Another problem cited is the huge working load on teachers that eventually results in poor teaching. Students being irregular in class is also an issue; once one or two classes are missed, the catching up may not be easy for students (or many students think so). A solution proposed for most of these issues is the flipped classroom teaching.

What is it?

Flipped classroom is a “pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter” (The Flipped Learning Network, 2014). Simply it means that the students watch a lecture and attend the class to do an

activity based on the lecture with help of the teacher. Earlier the lecture was held in the classroom and the activity was an home work. This is flipped here.

What happens?

There are two spaces here; 1) the individual learning space (say home or hostel) and 2) group learning space (classroom).

Therefore, two different sets of specific actions happen here.

a) What students do at home in a Flipped Classroom

- Watch an online lecture
- Preview online course material
- Read physical or digital texts
- Participate in an online discussion
- Perform extra reading

b) What Students do at college in a Flipped Classroom

- Skill practice (guided or unguided by teacher)
- In-person, face-to-face discussion with peers
- Presentations
- Practice problems
- Innovate or make designs
- Lab experiments
- Peer assessment and review

What is the procedure?

Jeff Dunn (2014) has proposed an easy 6 steps procedure for implementing flipped classroom teaching:

1. **Plan:** Figure out which lesson in particular we want to flip. Outline the key learning outcomes and prepare the lesson plan.
2. **Record:** Instead of teaching this lesson in the class (which we earlier did), make a video. Make sure it contains all the key elements we would like to mention in the class. Make it engaging and clear. Make short, multiple videos (say 10-15 minutes duration each) for the 1 hour or 2 hours class with proper title and numbering. Incorporating interactive quizzes within the video is recommended for keeping the students involved while watching it.
3. **Share:** Send the video to the students. Ensure that the file size is minimum and in the process, the video quality is not compromised. Select appropriate online medium to make it accessible or available to students. Inform students that the content of the video(s) will be fully discussed in the class.
4. **Change:** Now that the students have viewed the video(s), they're prepared to actually go more in-depth than ever before. Encourage them to read additional materials and provide them the same. If possible, provide them an option to post their doubts online.
5. **Group:** In the classroom, an effective way to discuss the topic is to separate students into groups

where they are given specific tasks to perform. Make each group to write notes, conduct quizzes, solve problems, make designs, propose solutions, innovate, etc. within the classroom itself. Note that these activities were 'home works' earlier.

6. **Regroup:** Get the students back together to share the work of individual groups with everyone. Ask questions and make them think deeper than ever before.

After the six steps,
Review, Revise, and Repeat!

Some other strategies that can be used in the classroom activities include:

- Active learning. Allow students to apply concepts in classroom where they can ask peers or instructors for feedback and clarification.
- Peer instruction. Students can teach each other by explaining concepts or working on small problems.
- Collaborative learning. Collaborative learning activities could increase student engagement, enhance student understanding, and promote collective intelligence.
- Problem-based learning. Class time can be spent working on problems that can last for the duration of a semester.
- Discussions or debate. Give students the opportunity to articulate their thoughts on the spot and to develop their arguments in support of their opinions or claims.

How to implement it?

For a 3 credit course, there will be 3 contact hours per week. In traditional classroom, all the three hours will be lecturing by the teacher. In Flipped Classroom, this can be performed in multiple ways.

It is assumed that there are 60 students in a classroom. In Flipped Classroom 1, the whole class is divided into 3 groups with 20 students in each group. For Flipped Classroom 2, the class is equally divided with 30 students in each group. Flipped Classroom 1, one hour is spent for each batch and for Flipped Classroom 2 it is 1.5 hour per batch. So in Flipped Classroom 1, in a week, the teacher teaches one hour the same topic for Batch A first, then Batch B and finally Batch C. Whereas, in Flipped Classroom 2, it is 1.5 hour classroom on the same topic for the two groups. It may be noted that in the two flipped classrooms, the contact hours of the teacher is 3 hours. In traditional classroom also the teaching happens for 3 hours; however, we can't ensure that the learning will happen for at least 3 hours. For 2 hours individual learning space, the teacher cannot give a video of 2 hours duration. Ideally 60 to 80 minutes videos are recommended based on the pace of study of the students. Students may follow the pause, rewind and proceed mode. It may be noted that the study time at home or hostel is for re-watching the videos, memorize, revision, to do more practice problems, etc.

Comparison table between a traditional and two flipped classroom models

Learning Hours	Traditional Classroom (hours)	Flipped Classroom 1 (hours)	Flipped Classroom 2 (hours)
Group Learning Space (classroom)	3	1	1.5
Individual Learning Space (home/hostel)	0	2	2
Study Time at Home	3	3	2.5
Total Learning	3	6	6

Once the students have watched the video and understood the topic, one question that can arise is what will the teacher do in the classroom. A suggestion of activities that can be conducted by the teacher in the group learning space (classroom) is provided.

- First 5-10 minutes: A re-cap quiz (with some weightage in grades) to ensure that students have watched the videos.
- Next 15-20 minutes: A summary about the content of the videos given to students for watching.
- Next 15-30 minutes: A question-answer session for clearing the doubts of the students.
- Final 15-30 minutes: A tutorial session for practicing problems, making designs, innovate, improvise, etc.

It may be noted that the planning of the group learning space depends on the topic, the teacher and of course the students.

What are the differences?

In traditional classroom are mainly teacher centric ones; while in a flipped classroom the student

is at the centre. A more conducive environment for learning is provided by the flipped classroom; while the traditional ones ensure only teaching, not particularly learning.

Flipped classroom is more student friendly; while, traditional classroom can be neither teacher nor student friendly.

How it can be improved?

A suggestion to improve the quality of Flipped Classroom is by making the teacher to conduct a live (online) classes instead of recorded video sessions. During a time of social distancing, there are arguments like why not a teacher handle a class as in the traditional classroom through online mediums like Zoom or Google Meet or Microsoft Teams. Definitely it is good method provided all students have equal and uninterrupted access to internet. Otherwise the students will poor or no internet connections will miss or get distracted during the class. Also it is difficult to ensure that all our students are really listening to the teachers even though 'they are online'.

What are the advantages?

There are many advantages for Flipped Classroom especially when considering the new generation, technological developments and its associated changes in the society. Some of them are listed.

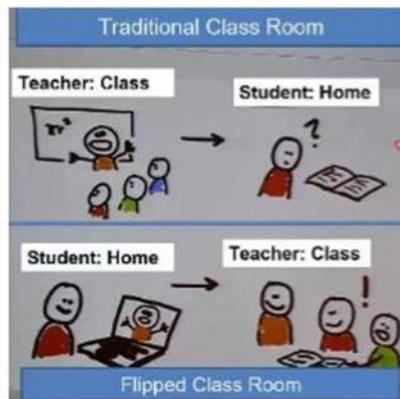
- Speaks the language of today's students.
- Keep students busy.
- Helps struggling students.
- Provides students the option to excel.
- Permits students to pause and rewind.
- Improves student-teacher interaction.
- Allows teachers to know their students better.
- Increases student-student interaction.
- Changes classroom management.
- Transform the attitude of parents towards teaching and learning.
- Makes the class transparent.
- Helps absent teachers.
- Promotes self and life-long learning.

A Comparison table between traditional and flipped classrooms

Traditional Classroom	Flipped Classroom
Fixed timing and place	Flexible timing and place
Focus on teaching	Focus on learning
Only few students are the target	All students can be targeted
Listen once	Listen multiple times
Learning pace depends on teacher	Pace of learning students can decide
Only few doubts can be cleared	Many doubts cleared by teachers as well as the peers
Immediate feedback possible	Time lagged feedback only is generally possible.

What are the disadvantages?

Just like any other teaching-learning strategies, the flipped classroom teaching comes with certain disadvantages. While the advantages are tremendous, the disadvantages are unavoidable. Major drawbacks of flipped classroom learning are related with the technology issues, the resistance to change, lack of motivation and also it is something not for every student. Many argue that flipped classroom teaching divides students digitally since the technology required (computers, smart gadgets, internet, etc.) are not accessible to many individuals. Flipped classrooms that utilize videos to deliver instruction sometimes suffer technical challenges/difficulties. Teachers and students can solely become dependent on technology.



Another major allegation is that the human element in the teaching-learning process is reduced. Because of it, there will be an increase in the time spent by students in front of computer screens. While online, there can be a lot of distractions. The additional time the students have to spent at home for going through the videos is also debatable.

Some people also believe that the flipped classroom would become a major threat to the traditional classroom teaching method.

Conclusion

The flipped classroom approach is found to be useful when seeking maximum utilization of class time, ensuring high achievement of learning outcomes, providing flexible learning environment, creating opportunity for higher thinking, and also for enhanced teacher-student and student-student interactions. The success of a flipped classroom approach hinges on the synergy between teachers and students as well as their technology friendliness. When used appropriately, flipped classroom is definitely a valuable addition to the teaching-learning process in higher education sector especially from the perspective of social distancing.



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GROWING SIGNIFICANCE OF ALUMINUM ALLOYS

Strict emission control norms, urge for competing fuel efficiency and environmental commitment push vehicle manufacturers to incline towards usage of lightweight sheet metals. Aluminum and magnesium alloys moves forward as alternative to traditional steel sheets in this scenario.

Interest in the usage of aluminium alloys for vehicle manufacture is steadily increasing due to their lightweight, reasonable strength, acceptable formability and corrosion resistance. More than 80% of the cars made in Europe are manufactured with aluminum. Appreciable mass reduction has been achieved by the use of sheets and press formed parts in aluminium alloys. Automotive manufacturers like Porsche, Audi, Daimler-Benz, Volvo and Ford employ deformable aluminium alloys for parts such as doors, radiators and wheel rims. In addition, Al-Mg-Si cast aluminium alloys are used in engine. In addition, Al-Mg-Si cast aluminum alloys are used in engine, transmission and suspension (Fridlyander et al., 2002).

Replacement of the traditional welded steel variant with modular aluminium structures such as Audi A8 space-frame results in chassis part weight reduction by 25% and body part weight reduction by 50%. In addition, the body panels and body floor are also fabricated with aluminum. Other than in passenger

cars, aluminium alloys can be used in special purpose vehicles such as tractors and haulers in order to raise the payload and minimise the maintenance cost. Furthermore, aluminium has wide general purpose applications such as body panels of laptops, mobile phones and in kitchen utensils and cabinets.

It is to be noted that aluminum merits over steel with 3X lesser density, better corrosion resistance and high degree of utilization, but the cost of aluminium alloys is 2X higher than that of steel (Jain et al., 2002). However, benefits in organizational, operational, manufacturing and design sectors mitigates the burden of high cost of aluminium alloys. Specifically in the manufacturing sector, recyclability, corrosion resistance and mass production of aluminium alloys can bring noticeable positive result over its higher cost (Das et al., 2007). Secondary requirements of sheet metals such as adhesive bondability, spot weldability and high quality paint finish are added advantages for aluminium alloys. (Burger et al., 1995)

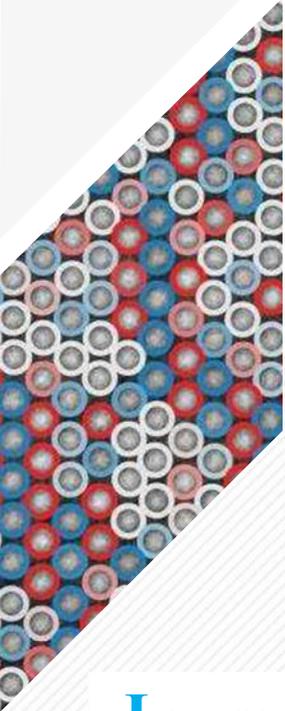
Non heat-treatable alloys such as Al-Mn 3XXX series and Al-Mg 5XXX series as well as heat-treatable alloys such as Al-Cu 2XXX series and Al-Mg-Si 6XXX series are preferentially suitable for automotive structural and skin applications. Out of which 5XXX

and 6XXX aluminium alloys are commonly used in automotive industries (Burger et al., 1995). 6XXX is costlier than 5XXX, but 6XXX provide better mechanical properties than 5XXX. The most cost effective approach for body-weight reduction is to use tailor-welded blanks of 5XXX and 6XXX aluminum alloys.

6XXX is preferentially used in external body panels due to the ability to harden with partial aging during the paint bake cycle and the absence of Chernov-Leuder lines, subsequently better aesthetic appearance can be obtained. Although less formable, 6XXX achieves high strength after paint bake cycle. 5XXX softens and loses some of its mechanical properties during the paint bake cycle. Rapid work-hardenability, softening and susceptibility to the formation of Chernov-Leuder lines limits its application to internal parts only (Burger et al., 1995, Das et al., 2014). It is clear that a single aluminium alloy cannot suffice for both structural and skin applications simultaneously. Therefore, a combination of 5XXX and 6XXX aluminium alloys is a viable solution owing to their own specific metallurgical characteristics.

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HIGH ENTROPY ALLOYS

It is well known that alloying can make drastic changes in mechanical and chemical properties. The addition of other elements is usually restricted to only small amounts due to number of reasons like high cost of alloying elements, structure sensitive properties of commonly used base metal like iron, more amounts of alloying elements forming brittle intermetallic or other complex phases which seriously affect the usability of the resulting alloy. However an interesting experiment was conducted in 2004 by Yeh in which they added 4 and more components in equi-atomic concentration. That experiment showed results which was not obvious and created a new area of modern material science called High Entropy Alloys (HEA). High configurational entropy of mixing is one of the major deciding factors for the formation of these alloys and hence the name. Gibb's free energy can be lowered

through high configurational entropies making the phases stable at high temperatures. These alloys having generally more than five elements in equiatomic compositions show an enormous increase in configurational entropy making it thermally stable even in high temperatures. These alloys show single phases or at least two phases having simple crystal structures like FCC, BCC in contrary to the condensed phase rule which predicts C-1 phases (C= no of components). These alloys show excellent corrosion resistance, oxidation resistance, wear resistance, good compressive strength making it suitable components for many engineering applications. Several methods have been used for the synthesis of HEAs, but most commonly used are arc melting and mechanical alloying for bulk HEA production. Several coating methods such as laser cladding and thermal spraying have been used to synthesize HEA coatings. These coating methods need careful preparation of powders and several other steps which make the process more complex and expensive. Mechanical alloying followed by sintering is one of the promising routes for developing nano crystal line HEAs. Literatures have shown that these alloys possess many promising properties and by carefully controlling elemental compositions properties can be enhanced

which makes them a possible candidate for many engineering applications.

Ni₃₀Co₃₀Fe₁₃Cr₁₅Al₆Ti₆ HEA processed through Vacuum Arc melting exhibits exceptional strength and ductility at 77 K showing an ultrahigh tensile strength of 1.7GPa and a large ductility of 51%, accompanied by a distinctive three-stage strain-hardening response. Nano precipitates were observed in these alloys which results in nano-spaced stacking faults which prove as a new effective toughening mechanism for achieving large plastic strains in high-strength precipitation-hardening materials. Apart from these HEAs with selected compositions exhibits good fracture toughness, electrical and thermal conductivities and magnetic properties.

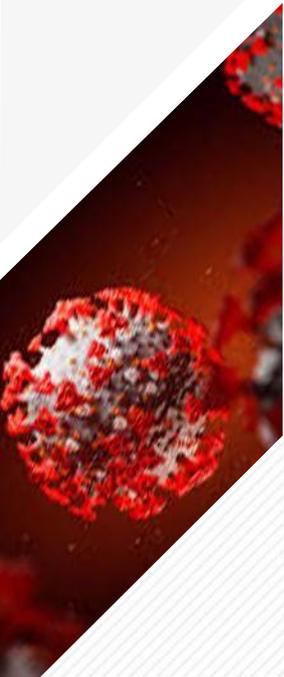
HEAs have superior properties compared to most of the conventional alloys which can lend them applications in aerospace, structural, automobile, food and energy sectors. More and more researches are happening across the globe in HEAs which helps them to replace their conventional counter parts.

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Advanced Medical Image Processing By Integrating Deep Learning

Technique for Potential Identification of 2019-nCoV / Coronavirus 2



Since the advent of the novel Coronavirus (SARS-CoV-2), first reported in December 2019 as "Pneumonia of unknown cause" in Wuhan City, Hubei Province, China. This virus had caused disastrous global consequences to humanity, trespassing the human immune system the key to a solution remains unclear. Declared as a pandemic on March 11, 2020, the disease was officially announced as a "public health emergency of international concern" by the world health organization (WHO). Leaving no clues behind, this virus uses its imminent mechanism to invade from identifying its heart. This deadly disease can be in any form, from carriers to victims. Identifying its state and stage can significantly demote its impact on society. Nearly every disease has their strategy while they invade the immune system of the hosts. Novel Coronavirus (SARS-CoV-2), attacks primarily to the respiratory

system, progressing from minor to severe conditions, leading to death.

Diagnosing this virus is a challenge since researches are in progress, but the spectrum of radiological patterns seen in COVID-19 has gradually become visible with up-to-date publications and reports. Image processing has a significant role in every diagnosis of almost every condition of a human body. Unwrapping the radiological spectrum behind a conventional pattern by employing image processing can impart astonishing results, which can supplement early diagnosis. Image processing is somewhat an extra magical tool to see or view beyond capabilities. Integrating the aptitudes of an image processing algorithm with a neural network will significantly change the way of diagnosis.

An algorithm is focusing on image processing and a deep learning technique with its neural network having the heart of intact functions and logical formula cast to it will now have the ability to reveal the hidden traits.

For the immediate deployment to the society, an advanced image processing algorithm by integrating deep learning techniques has been developed and found to be promising towards effective diagnosis.

This algorithm evaluates the inputs from a CT scanner and analyzes its properties in an enhanced way by using various functions, which usually comes under the pre-processing criteria of this algorithm. After pre-processing, various intact functions had been deployed to derive the predominant attributes. The derived characteristics must be compiled to different functions to do various logical and mathematical procedures to assess the pre-processed data. After appraising the data, the functions transfer their values for further processing, where it is like a neural network. Propelling into distinct stages of processing, different results will be ready to be nourished with the input image. The segregated data from intermediate processing functions combine to obtain a threshold level to intensify the outcome. Here, the stages carrying the essential functions and neural functions are the core components of the algorithm. The intermediate results form the core spectrum of the algorithm. Every output describes the hidden traits of the input (Figure 1).

The intact functions are designed for COVID-19 findings to reveal the changes caused by

the disease, making it a unique feature at the stage of deployment. To reduce the identifying boundary of COVID-19 from a vast amount of other diseases without overlapping, the algorithm must be trained for COVID-19, even though it has some dedicated functions for it.

Deep Learning relies on the mass amount of data. Training the algorithm in this present scenario can have a significant impact on the diagnosis as well as the algorithm. Eventually, by training, the boundary will precisely be designated to COVID-19 pandemic cases. The cluster of data that was used for the training contains the boundary of other diseases; here the boundaries will be identified to form another cluster of data that points to other types of diseases. Each boundary identified becomes a collection of data clusters for a specific disease. These collections of data will be used for transferring the present algorithm to another level, called the Machine Learning Algorithm. Machine learning algorithm will finally lead towards Artificial Intelligence through a step by step process, which is the ultimate objective of this present algorithm. Finally, the algorithm will provide the ultimate diagnosis tool for the need in just a click and within a matter of seconds.

At the present stage, the algorithm is trained for COVID-19 with precise functions to detect GGO's (Ground Glass Opacification), vascular changes, Tree in

bud properties, peripheral changes, cavitation, consolidation, etc.. Adaptive segmentation intact functions will be deployed for identification beyond COVID-19 spectrum. Each result obtained from the algorithm gives unique information through a different spectrum. Indeed this research had proven that the developed algorithm significantly supplement the diagnosis for COVID-19. Further investigation is in progress towards more preciseness of the algorithm. The current gold standard for COVID-19 testing is designated to RT-PCR (Reverse Transcription-Polymerase Chain Reaction). Since this algorithm uses the CT spectrum, radiations, disinfection after testing, etc... Must be taken into consideration at its importance. The algorithm specifically targets the cases with suspicious conditions, tracking the progression of the disease and the condition with negative RT-PCR test cases. As this research focuses on the emergency deployment of its application, further investigations

are in progress and the current results are supplementing for effective diagnosis.

Imaging the differential diagnosis spectrum from the algorithm through various masks (Figure-1), promises for applying it towards identifying the potential key attributes in COVID19 scenario and person under investigation. The key characteristics are the essential formulae to critical decision making. Clear cut evidences with increased probabilistic conditions ensures this deep learning algorithm to classify virus and non virus infections, in which the results adds as a supplement towards the diagnosis of COVID-19.

“Data is a very powerful weapon against this virus”

- Dr. Tom Frieden, Former Director, Centre for Disease Control.

Prof. Erfan N

Assistant Professor
Department of Mechanical
Engineering

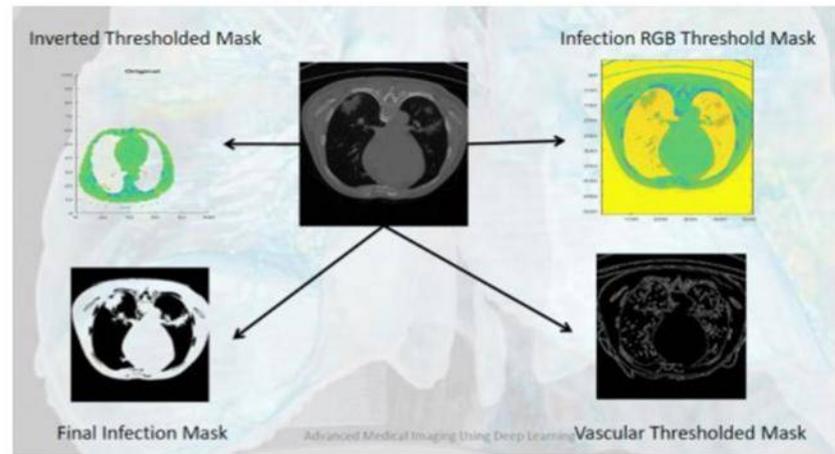
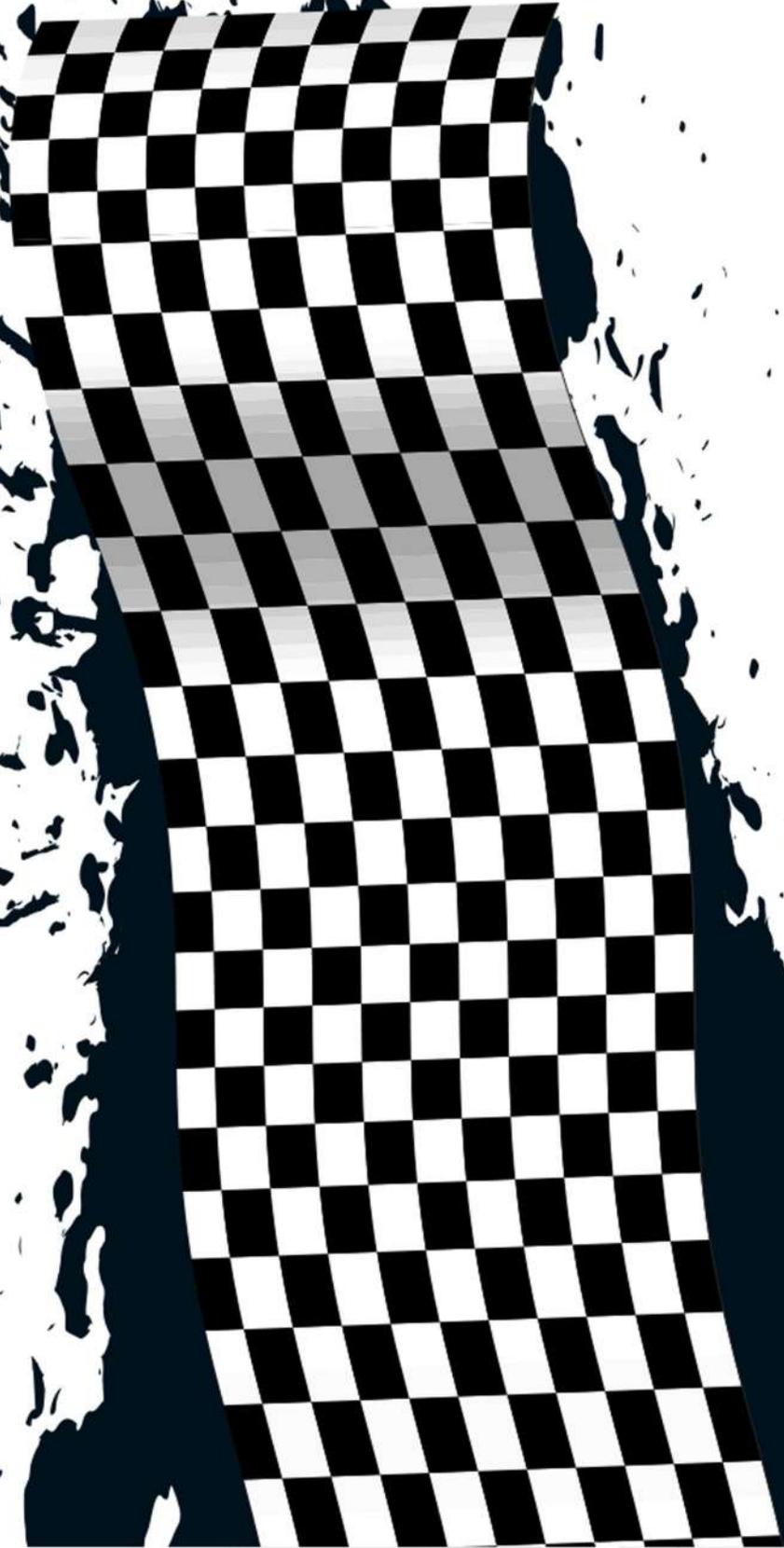


Figure – 1, The hidden traits from the developed algorithm



BIKERS

EXTREME

TRICKS



BIKERS XTREME TKMCE

Great legacies and initiatives have always been a wonderful part of the History of minarets – Conjura, Backathon, Wheelz and much more. As time elapsed, the batons were handed over and the legacies continued.

And Wheelz?

Back in 2011, Wheelz was the pride of the Mechanical department. It was the largest and the most awaited auto expo held in Kerala. This Automotive spectacle conducted in a very professional manner attracted a large crowd. Wheelz added another golden feather to the Mechanical Department.

But Wheelz had to slow down and brake for a couple of years.

But the journey wasn't over yet.

Wild beasts with immense power have always fascinated the motorheads. Throughout the years, great efforts have been put in to bring back the great legacy.

The year 2020 has seen a leap in the race. Bikes and rides have always inspired people to travel and to see the world around us. Some rides even shaped the world like Che Guevara's Motorcycle Diaries revolutionized everything. As the bike fanatics in the campus united for a cause, a cult was born, the B X T.

Bikers Xtreme Tkmce started in full throttle. With all the juniors and seniors hand-in-hand and Mexsym on full spirit, the campus was about to witness the comeback of a great event.

By 27th of January 2020, the department issued the permission for the expo. And we were a step closer to the realization of a big dream. As the team moved forward coping with all the challenges through pure energy and zeal, a new epoch was added to the tales of the campus.







Every one on the campus was ready to spectator the extravaganza as TORC made their majestic entry on 7th of March 2020. Adrenaline rush was at its peak as an S1000RR revved into the arena with its immense power. The crowd stood marveled as the beasts accelerated to the array on full throttle.

Around 23 superbikes & two iconic supercars rumbled down the narrow streets, bringing the people down just to watch the spectacle which brought up the excitement and attraction of BXT.

One of the biggest attraction of the expo was the Kawasaki Ninja H2, one of the fastest production motorcycles with a top speed of 300 km/hr and the only bike that sports a monstrous supercharger churning out a maximum of 231 horse power. The Ninja H2 is a dream for every superbike devotee.

While the Kawasaki ZX10RR and Honda CBR1000RR conjured the crowd with their pulsating roar, the elegant sight of the Triumph Thunderbird mesmerized the gathering.

Yamaha YZF R1 with its magnificent attire and notable features grabbed the attention of the crew and overwhelmed them with its rich rattling.

It was indeed a proud moment when the revving echoed through the minarets. Everyone's heartbeat followed the rhythm of the perfectly timed engineering charisma of super bikes. And it was one hell of an experience.

The Trivandrum super bike club, TORC and Havoc Angels made a grand spectacle and they conquered the minds of all the superbike enthusiasts!

TORC was formed in 2015 as a platform for the superbike owners in Trivandrum to interact and share experiences. TORC is one of the very few clubs in the country that is officially registered under the government. One of the major highlights of the group rather than group rides and college expo meet ups is the amount of charity works the group has been doing.



We are incredibly grateful for the financial assistance provided by Supreme Traders, Kollam and Sarathi Motors, Karicode. We value your support and sponsorship and your contribution has helped us accomplish a lot.

Our heartfelt thanks to Nihal for his sincere efforts and contributions.

It was the Mechanical Department which gave us the green light to the race of B X T which became the much appreciated event of Hestia'20 and thanks to the department for the support and guidance. Nothing would have been possible until the team rowed with zest towards the only goal with determined minds like a race car which was the ultimate success of B X T. The whole crew marked the huge success of B X T.

Kudos to everyone who stood beside us and joined hands to make this venture a great triumph!

“The idea here is simple, if you can dream it, it is possible”
– Jorge Lorenzo

Gracias!
Team B X T

ACHIEVEMENTS



Sponsored Research/Consultancy

	Name of faculty	Project Title	Project Type Research/ Consultancy	Funding Agency	Amount (Lakhs)	Duration
1	Dr. Mathew Skaria, Dr. K A Shafi. & Dr. Rijo Jacob Thomas	Development of capacitance based Flow meters for laminar two phase flow of liquid nitrogen	Research	DAE, BRNS	21.51	December 2019- November 2021
2	Dr. AnandSekhar R& Dr. Mubarak Ali M	Development of aluminium metal matrix composites using marble dust as a novel reinforcement	Research	TEQIP-II	1.0	December 2019- November 2020
3	Dr. Baiju V	Experimental investigations on performance characteristics of briquettes from water hyacinth and agricultural wastes	Research	TEQIP-II	1.5	December 2019- November 2020
4	Prof. Mohammed Zakkeer & Prof. Resmi S L	Numerical and experimental investigations on rabbit bone	Research	TEQIP-II	1.29	December 2019- November 2020
5	Dr. Mubarak Ali M	Direct solar heating aided vacuum bag curing process of glass fibre reinforced composite laminates	Research	CERD	1.63	November 2019- November 2021
6	Dr. Ashfak A	Joint inspection of rectification of the damaged slipway at Ayittykadavu, Payyanur, Kannur district	Consultancy	Steel Industries Limited, Kerala (SILK)	0.70	November 2019-October 2020
7	Dr. A. Sadiq	Investigation into soft body impact on laminated composites	Research	Aeronautical Research and Development Board	19.9	February 2020

8	Dr. Mubarak Ali M & Dr. Rijo Jacob Thomas	Investigations on cryogenic treatment of natural fiber reinforced composites for sustainable automotive industry	Research	TEQIP-II	1.0	August 2019 - August 2020
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Faculty publications list

Sl No.	Title of publications	Type of Publication	Year
1	A Sheeba, M. Jose Prakash, Heat transfer and flow characteristics of a conical coil heat exchanger, International Journal of Refrigeration, Vol. 110, Pages 268-276, Accepted on Oct 2019.	Journal (ISI Indexed)	2019-20
2	Hashim V, Resmi SL Jesna Mohammed, .Dileep P.N, Impact of Geometry Effects on Artery Stent Deployment Characteristics, International Journal of Engineering and Advanced Technology (IJEAT), Accepted in Dec 2019	Journal (Scopus Indexed)	2019-20
3	AgeshMarkose, Effectiveness of Polyurea Coated Steel Plates in Blast Mitigation in Vehicles, RV Prakash et al. (eds.), Structural Integrity Assessment, Lecture Notes in Mechanical Engineering, Springer Nature Singapore Pte Ltd., 2020	Book Chapter	2019-20
4	K E Reby Roy, Investigations on the Heat Transfer of Cryogenic Fluid Flow Through Coated Helical Channels, The First Graduate Forum of CSAA and the 7th International Academic Conference for Graduates of NUAA, Nanjing, China, 2019	International Conference	2019-20
5	K E Reby, Influence of channel width and pumping pressure on heat transfer and fluid flow characteristics of rectangular microchannel heat sink, IMAT 2019: The 11th International Meeting on Advances in Thermofluids, Kyushu University, Fukuoka, Japan, November, 2019.	International Conference	2019-20

SPORTS ACHIEVEMENTS

The KTU Sports Annual Meet is conducted every year where students from all the engineering colleges across Kerala compete with each other in the University Stadium in Trivandrum.

The following students of the mechanical department have bagged the prizes for the respective events in the Sports Meet.



Niranjana Madhu
3rd year Mechanical Production
Hammer Throw - Silver 2018-19 and 19-20



Muhammed Asif K K
4th year Mechanical
Hammer Throw - Bronze 2018-19



Sayuj Jayadev
4th year Mechanical
4×400 Relay - Silver 2019-20



ASSOCIATION REPORTS



MECHANICAL & PRODUCTION ENGINEERING ASSOCIATION INAUGURATION

The inauguration of Mechanical and Production Association was held on 14-10-2019 at the college auditorium. The chief guest for the occasion was Mr. Alex A, General Manager, Cryo-Engine, LPSE, ISRO. The event was formally inaugurated by lighting the lamp by the chief guest in the presence of the Principal, HOD and other staff members of the Mechanical Department. They also launched the official logo of the Mechanical Association 2019-20. Mr. Jishnu G Nair (Mechanical Association Secretary) of 4th year Mechanical Engineering welcomed the gathering and all the dignitaries in the dias were honoured with pleasantries. Dr. Mohammed Sajid N K, HOD, Dept. Of Mechanical Engineering, delivered the presidential address. The chief guest, Mr. Alex A gave a scintillating speech and enlightened the young minds. He also urged the students to utilize the opportunities presented by the association to develop their skills. Prizes were distributed for students who excelled in various activities like Electric Two Wheeler Design Challenge, Tractor Design Competition, EffiCycle and EFX conducted by Society of Automobile Engineers and American Society of Mechanical Engineers. The function was felicitated by Dr. T A Shahul Hameed, Principal, TKMCE, and Dr. Thilakan Haridasan, Professor, Department of Mechanical Engineering. This was followed by the vote of thanks by Mathias Binoson (Mechanical Production Association Secretary) of 4th year Mechanical Production Engineering. The official function came to an end with the National Anthem.



Jishnu G Nair
Mechanical Association
Secretary



Mathias Binoson
Mechanical Production
Association Secretary



Prof. Jesna Mohammed
Association Advisor

TALK ON ADVANCED FABRICATION PROCESSES

The Mechanical and Production Engineering Association of TKM Engineering College conducted an interactive session on 14th October 2019, Monday at 4:30pm in the Jubilee Hall. The talk was led by an eminent personality in the field of Indian Space Research Organisation, Sri. Alex A, General Manager, Cryo engine, Liquid Propulsion System Centre, Valiamala, on the topic “ADVANCED FABRICATION PROCESSES FOR LIQUID ENGINES”. He shared his views on the latest advanced technologies that ISRO has been following for recent projects like Chandrayan and about the manufacturing, moulding and arrangements of components for rockets through presentation slides. He described the different types of rocket engines and expanded on the liquid propellant rocket engines. He pointed out the challenges that space researchers face in the current scenario and the possibilities that help to overcome it. Around 250 aspirants were gathered for the session that lasted 90 minutes. The talk helped enhance the knowledge and piqued the interest of the attendees. The vote of thanks was given by Megha N from first year Mechanical Department. The session dispersed by 6pm.



MEEDU SCHOLARSHIP

Mechanical and Production Engineering Association has taken a step towards the empowerment of those brilliant students who need a helping hand financially. Our association advisor Prof. Jesna Mohammed and Prof. Shifin identified two such students in our department. Mechanical Department HOD Dr. Mohammed Sajid handed over the scholarship amount of INR 4000 to those students on 21/10/2019. MeEdu Scholarship is also a new initiative taken by the Mechanical and Production Engineering Association this year



CAREER BUOY

Career Buoy is a new initiative undertaken by the Mechanical and Production Engineering Association in the year 2019. This programme aims at creating a link between the alumni of Mechanical Department with its students in order to absorb the guidance and supports related to placements and internships that may be amassed from the experienced professionals. Presently, we have a lot of alumni working in reputed companies at high positions all over the world. There is so much untapped potential in this. The students of our college are well versed in theoretical aspects owing to our pristine faculty. In today's competitive world, the moulding of one's career while still in college is essential. For this, proper guidance from our alumni would go a long way towards building better equipped professionals.

Aim of Career Buoy: To shape students as per the current industrial demand by providing them with skill improvement platforms such as workshops, MOOCs, seminars and courses as directed by the alumni within their respective industries.

The whole process takes place in 3 phases:

Phase 1 - Creating a comprehensive database of alumni.

Phase 2 - Coordinators or faculties in charge will contact these alumni to ask for their guidance for the above mentioned skill improvement programs and enrol students for internship in the recommended industries.

Phase 3 - In the long run, these companies may approach the institution for placements in view of their satisfaction with the interns.

How Career Buoy works?

Mechanical and Production Engineering Association is responsible for conducting these skill improvement programs. 3rd year students will be the coordinators of Career Buoy and the association advisor is responsible for guiding these coordinators. Coordinators or staff advisors will be in contact with the alumni and make an agreement with them regarding internship of students. We are glad to say that this year, we could complete 1st phase of this initiative successfully. This academic year, 2019-20, the coordinators of this program were Adil Hussain, Sooraj, Afsal Saleem, Ashik Anil Jacob of third year Mechanical department .

This whole process was planned and started by December 2019.

ELECTRIC VEHICLES WORKSHOP



The Mechanical and Production engineering Association organized a workshop on ‘Foundation to Electric Vehicle’ conducted by Mr. Suraj S D from Decibels Lab PVT LTD. Mr. Suraj S D is a passionate supporter of electric and sustainable mobility. He founded Competences Factory (CF) in 2017 to build trained and skilled resources in the automotive industry. He has worked with Infosys, HP, ITC and InfoTech, where he has engaged in projects for Mercedes Benz, Fiat, Chrysler and Fisher Dynamics USA. It was a one-day workshop that started at 9am and lasted till 5pm. It had a footfall of 52 students. The session included both theory courses and hands-on training. The topics covered were electric vehicle subsystems, hand calculations for battery and motor sizing, overview of traction batteries, EV architecture and Modelling of EV powertrain in MATLAB. The workshop was organized by Mechanical Association secretary Jishnu G Nair, Mechanical Production Association secretary Mathias Binoson, Basil and Mohammed Dilshad. It was conducted in a very interactive manner. It concluded with a feedback session from Advaid, Aishwarya and Joel Prekash.

GEAR UP

Gear Up is the official app of the Mechanical Production Engineering Department of TKMCE. It is the result of a lot of hardwork and dedication. This venture had been initiated at first by our former Association Secretary Sunu Sundar and was completed this year under the leadership of the present Secretary, Mathias Binson. The motive behind the creation of this app lies in the fact that our chosen branch is found only in a very few colleges across Kerala. Students were thus, facing difficulties in accessing notes and other study materials since they are scarce or disorganized. As a result, the association brings forward Gear Up, which provides an organized collection of notes and question papers. Rahul Jojo and Poornima Padmakumar of third year Mechanical Production were the main coordinators behind the initiative.

All notes and provisional question papers are collected from students in order to maintain a self explanatory style. The application interface is arranged semester wise which helps in saving time from the student's point of view. It includes subsections too. The application has been used by most of the students as they found it to be very helpful. Gear Up has thus, helped every user to gear up their knowledge.

INTRODUCTION TO C++ WORKSHOP

Mechanical and Production Association, in collaboration with the Institution of Engineers (Mechanical Production chapter) conducted a 2-day workshop on “Introduction to C++” on 23-24 November 2019. The workshop was conducted by Mr. Sumod C P, who works as Assistant Professor at UKF College of Engineering, ML Trainer at ASAP and IEEE-KYP-Academic Coordinator. The workshop was organized with the support of Prof. Mohamed Shahid, Faculty Coordinator of Institution of Engineers Mechanical Chapter. The event coordinators were Bipin Ravindran and Anandhu Anil.

The workshop was aimed to give basic and practical knowledge of C++ programming, beyond what was included in the curriculum, for the third year students of the Mechanical Department. The first session was conducted on 23 November 2019 from 9am-4pm at the CCF facility. 32 students from 5th semester Mechanical Department attended the workshop. The basics of C++ programming were covered on that day with the students being allowed to practice the programs they had learned. The second session was conducted on the next day with the same timings. More in-depth topics were covered and by the end of the session, almost all of the programming part of the syllabus of the course “Computer Programming and Numerical Methods” was covered. The workshop succeeded in effectively helping the students understand the practical as well as theoretical side of C++ programming. Responses from the students were overwhelmingly positive and they concluded that the workshop had proved useful for them in their exams as well as benefited their understanding of programming.



OPPORTUNITIES FOR MECHANICAL ENGINEERING GRADUATES

The Mechanical and Production Engineering Association organized a half day technical talk on opportunities for Mechanical Engineering graduates on Monday, 10 February 2020 at Jubilee Hall in association with Career Guidance and Placement Unit. The talk was conducted by Mr. Anand Shankar who secured his first job through campus placement in L&T where he worked as a Fabrication Engineer and also as a Planning Engineer for 4 years in India's first nuclear submarine. He cracked GATE and SSE exam in 2015 and secured a job at ONGC where he is now working as Driller/Drilling Engineer for the past 4 years. Secretary of the Mechanical Engineering Association, Mr. Jishnu G Nair welcomed the gathering, with the talk commencing by 02:30 PM.

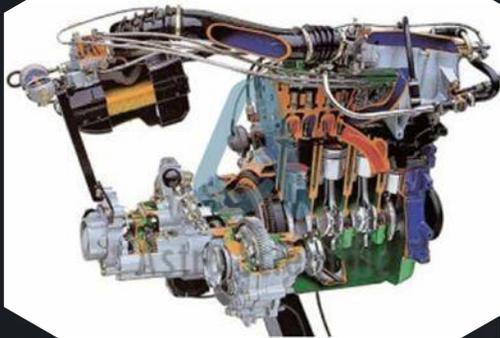
Mr. Anand Shankar explained in detail the wide variety of opportunities available for Mechanical Engineering graduates such as certified add-on programs, higher education options, the availabilities in the job market, employment options in the public sector, GATE examination and the preparation for it. The two-hour session was very informative to the average college-goer. There was an interactive session at the end during which around 10 students clarified their doubts about the related topics. A total of 190 students including the second, third and fourth year students from both Mechanical and Production Engineering branches were present for the talk, which concluded at 04:30pm with a vote of thanks by Mr. Aadil Hussain, a third year mechanical engineering student.



PROCUREMENT OF MPFI ENGINE FOR OVERHAULING

The Mechanical and Production Engineering Association handed over a dismantled Maruti Suzuki Petrol Engine to the Heat Engines Laboratory of our college.

The 3-cylinder MPFI type engine churns out 849cc and is coupled to a 4-speed transmission. Until now, there was no engine in our Heat Engines Laboratory that could be taken apart by the students. From now on, the students can study in detail, the intricate parts of the engine by dissecting each and every part and thus, acclimatize themselves in a way that wasn't possible until now. Moreover, our Heat Engine Laboratory only consisted of Carburettor engines and thus, this would be a very useful addition to our array of Heat Engines.



The engine was procured on 31 January, 2020 at a cost of INR 5000, which was paid for by the Mechanical and Production Engineering Association. It was dismantled and cleaned before being set up in the Laboratory. Technical learning systems nowadays simply stick to a theoretical curriculum which ruins the practical side of Engineering. This initiative, however, manages to impart the much needed practical knowledge to the students. The primary objective here is to give the students a good grasp over the construction, working, maintenance and repair of engines.

The students behind this initiative were Mathias(P8), Jishnu(M8), Ajesh(P8), Hardik Ramath(P2), Ebin(M8), Hari Rajesh (M8) & Mohammed Shah(M2).

MEXSYM

This year, Hestia'20 entered our lives as the synonym of opportunities and has been etched forever onto our hearts. Hestia '20 spanned over 4 days from March 5 to March 8, 2020. All the preparations under Mechanical Department were headed by Association Secretaries, Mathias Binoson and Jishnu G Nair. The main coordinator was Sayuj Jayadev. Four stalls were allotted for the whole department.

The gateway towards mechanical block was attractive due to the ROYAL MECH installation. The Electric Scooter was an innovative idea that bloomed from the minds of first year Mechanical students. Hydraulic Car and Hydraulic press were also exhibited. An 8'*10'; model Wall Climbing Robot was also fabricated. The Arduino CNC Drawing Machine was a major attraction which is a CNC-based drawing robot. The Compressed-air engine model grabbed the attention of a lot of students. A self-balancing hover board consisting of two motorized wheels along with a miniature hyper loop model which uses electromagnetic motor is worth special mention. The demonstration of CBT, front differential, 2D printer and Mechanical clock were also exhibited in the stall.

The Mechanical Production Engineering students welcomed this years Hestia with the new MECH PRO Logo launch. A handful of everyday used items were used to bring life to the logo installation. Three mechanisms were exhibited, including Tchebicheff mechanism. One of the other exhibits was Maxwells wheel. The exhibits that attracted more attention were Invisible Sculpture and Tensegrity. The Dismantled Four Cylinder Petrol Engine deserves a special mention along with the Differential. Infinity cube and blended wing aircraft were presented. An artificial cannon was also built, which ended up becoming the most exciting project. We were also able to demonstrate the practicality of automation technology by controlling the lights and fans at the stall. On the third day, in addition to this, a gaming session was set up. A vibrant and energetic DJ session by Diego Miranda marked the end of this years eventful Hestia.

More than everything, the days and nights that were spent working on these projects taught us the. most important lessons on effective group work and turned these hours of toil into beautiful memories. This was the triumph of the fraternity that came together to overcome the hardships.



BXT 2K20

Great legacies and initiatives have always been a wonderful part of the History of TKM. Back in 2011, Wheelz was the pride of the Mechanical Department. It was the largest and the most sought-after auto expo held in Kerala. As a tribute to Wheelz, this year, the moto-enthusiasts at TKM pitched an idea to conduct a Superbike expo and that's how BXT2K20 took birth under the hood of the Mechanical and Production Engineering Association. The expo was conducted on 7/03/2020 as part of the techno cultural fest Hestia '20. Trivandrum Super Bike Club TORC and Havoc Angels made their majestic entry into the campus and grabbed the attention of all the enthusiasts with the rattling echo of their machine. There were many students in the Mechanical department who devoted valuable time to find sponsorship for this event to happen. Govind Viswam (4th year) and Mohammad Ashik (2nd year) played pivotal roles in coordinating this event in the best possible manner. The total budget of this event was 2.8 lakh. Around 23 superbikes and 2 luxury cars mesmerized the spectators. Supreme Bakers, Sarathi Motors and Harisree Restaurant were the sponsors of this expo. All the students of the Mechanical Department also contributed to the program.

BXT2K20 was a proud moment for all the Mechanical Department students. It was the Department of Mechanical Engineering which gave us the green light to BXT, one of the highlights of Hestia'20. Great gratitude goes out to the department for their support and guidance.



LET'S CRACK IES

The Mechanical Engineering Association of TKM College of Engineering had conducted a Webinar on “Cracking Engineering Services (IES): Experience Sharing and Clearing Doubts” on 8th of August at 7.30 pm for all the students of our TKM College of Engineering. Speaker of the Webinar was Ms. Anusha Das J. (Executive Engineer, Central Electricity Authority, Ministry of Power, Government of India.) She did B tech EEE from NSS college of Engineering Palakkad during 2004-2008, Upon completing B Tech she worked as a software engineer with TCS. She joined CET for Masters in Power Systems in 2012 and in 2014 joined the Indian Engineering Services as AEE (Assistant director.).

The topics of the session included how to crack IES exam, the possible opportunities on cracking the same etc. The talk was about 90 minutes of time. There was also a Question & Answer (Q&A) Session at the end. There was a total of 105 participants for the session. The webinar was totally very useful and good to broaden our horizon.



IES EXAM

Indian Engineering Services

GREASE NUT 2020

Grease Nut 2020 is the last initiative that the Mechanical and Production Engineering association has taken this academic year. This has been the most awaited creative venture that our students and faculties worked on during this pandemic period. This magazine portrays a glimpse into the national level laurels and research reports of our students and faculties. Nurturing creativity and inspiring innovation are the valuable end results of education and department magazine is a perfect combination of that. This creative venture has brought a collection scientific and literary expressions with distinct individual signatures. The editorial team and authors have put in commendable efforts to inspire the readers.

Staff editor Prof. Faraz, Editors Jishnu, Jovial, Ijaz, Akshay, Mathias and design head Adwaith, Jameel to name a few are the pillars behind its success.

The logo for 'GREASE NUT' is displayed on a dark background. 'GREASE' is written in white, uppercase, sans-serif font. 'NUT' is written in a bold, yellow, uppercase, sans-serif font, positioned to the right and slightly below 'GREASE'. The background features a large teal hexagon at the top and bottom, and a stylized gear or nut shape in the center.



SAE TRICE
ENGINEERING REDEFINED

SAE REPORTS



SAE EXECUTIVE COMMITTEE 2019-20



Athul Rahul K V
Chairman



Jai Krishnan
Vice-Chairman



Linjo Rejoy
Secretary



Amos Emmanuel
Treasurer



Midhun P C
Program Chair



Advaid Gireesan
Media & Publicity Chair



Jishnu G Nair
Reception Chair



Tinto Thomas
Student Membership Chairman



Anal Jayan
SEC Member



THE FEELING CALLED BAJA

BAJA SAE is an intercollegiate design competition run by the Society of Automotive Engineers (SAE). The event originated in the name of mini-BAJA, in the year 1976 at the University of Carolina. India is one of the six countries in the world where this event is conducted annually. BAJA SAEINDIA was launched in 2007 and from then on, nearly 300 teams from across the country compete in this extravaganza on an annual basis. The event is held in two stages, a virtual event in which the teams will present their designs and the main events which will be held as two separate events - one in Pithambur and the other in Punjab.

A BAJA team was started in our college in the year 2016 and a progressive growth in performance is evident. The milestones in performances can be pointed out as:

- 2016-17>Car Number 85-First team to compete.
- 2017-18>Car Number 113-Ran the endurance event but couldn't complete due to suspension failure.
- 2018-19>Car Number 76-Secured All India fifth rank and Kerala first rank.

The event is conducted in two stages - a virtual

presentation event and the main event. The main event starts with the technical inspection in which the co-ordinators will check whether the vehicle has been built according to the specifications in the rule book and even the slightest of mistakes can lead to disqualification. Once you pass the TI, the team qualifies for the brake test, in which you have to speed up to 40Km/h and then apply panic braking and make sure that all the four wheels have been perfectly locked. The team can participate in other dynamic events if and only if the brake test is completed successfully. This is followed by the acceleration test in which you have to hit the accelerator and obtain maximum speed. The other dynamic events include Suspension and Traction in which you have to ride the buggy through different rough terrains, the Manoeuvrability event in which you have to make the buggy go through and between obstacles which will check the handling of the vehicle and then there is the Sledge Pull event in which you have to tow a tractor over a specific distance. All this leads up to the big Endurance event, held on the final day, which purely is an all out race through a track. It is every participant's dream to

compete in the Endurance event. Points will be calculated according to the guidelines provided in the rule-book. The static events include Sales Presentation in which you have to present before a panel, the ideas and strategies adopted to manufacture and sell 4000 units of your buggy, the Cost Presentation where you have to display all the costs incurred and hence, clearly specify the different ways to produce the buggy cost effectively and the main static event is the Design Presentation in which you have to enter with the buggy and answer to questions by experts regarding each and every aspect of the same.

In the 2019-20 season, hopes were higher than ever and the start was great. We secured 47th rank in the virtual event from among 382 participants.



The work was in full swing and the machine we built was widely regarded as the best one yet. Luck, though, was not on our side. The extremely harsh climate in Punjab turned the plans on its head. Heavy rainfall throughout the day, submerged pits, team members doing their jobs under a tarpaulin sheet – the condition was quite adverse. Amidst all this, we cleared the technical evaluation which brought us joy. But then, fate had other plans. The extreme cold climate had marked effects on the properties of the brake fluid and it led to a failure in the brake test. Due to the harsh conditions and the protest that took place, one more chance was given the following morning and it was an effort that started from 9 at night to 5 in the morning to fix the issue. But bad luck, our frequent

companion came up for a visit once more - a failure in the master cylinder. Somehow, we managed to obtain a new one and kept on working until the very last minute, when the announcement came that the brake test has officially ended. A sense of agony and despair filled everyone. The hard work of a year, all the moments leading up to it - all flashed in front of our eyes. We were absolutely devastated.

It was then that we started to think about what we had gained from the event, all the priceless exposure we obtained from the work we had done and besides, the end result never matters as long as you are happy with your effort and indeed, we were. We decided to learn from this season, take the positives and come back stronger than ever next year with more grease, to deal with more mud and for obtaining higher glory!

The team was led by Jishnu.G.Nair, with Amal.C.Kadavath as the vice captain and Vazim Sir as our faculty advisor. The entire team was divided into six departments, namely – Roll Cage, Suspension, Steering, Brake, Transmission and Documentation- and the works were divided and done accordingly. The total expenses were around 6 lakh rupees of which around 80,000 rupees was funded by the college and 10,000 rupees was via sponsorship. We also take this opportunity to thank our sponsors - CAD Point and Palnar Transmedia for showing faith in us. We also thank the faculties and staff of the Mechanical Department and the Alumni Association for their support in all regards. Without them none of this would have been possible.



Captain's Note

“The preparation for BAJA 2019-20 began way before the academic year started. The main aim was to apply the knowledge we gained from texts and go beyond that on the practical aspect. The experience we gained from previous seasons, our seniors, other teams that we participated with and above all the failures we had in the journey helped us become stronger.

We concentrated on improving the performance of our buggy by emphasizing on weight reduction, steering response and acceleration and we did succeed in all these aspects. We were able to reduce the weight by 11 kilos from the previous model without compromising on the performance. We were able to obtain a brilliant turning radius of 1.7m for a better steering response and could improve acceleration by inculcating a change in the drive train. Analysis and simulation were our best allies in this regard.

The support we obtained from the workshop staff of the Mechanical Department and Afsal Sir in particular, is to be given special mention. The numerous problems we encountered during the manufacturing stage could not have been tackled without their help. The role Vazim Sir played as our faculty advisor in being the link between us and the college management was as important as any other thing in building our buggy. I must admit the fact that the 2020 edition of BAJA was the worst one in my experience due to harsh climate and unsatisfactory co-ordination. All I have to say is that my team and I are satisfied with our effort and that we believe that what we have built this year is by far the best of the buggies we have ever made.



I would like to end by thanking BAJA itself for being the platform that made us what we are now. The usage of modelling softwares like SolidWorks and CATIA and analysis softwares like ANSYS, LOTUS and ADMS has given us hands-on experience on what it is out there in the automobile world. The exposure we got from participating in this event is priceless, to say the least and it would not have been possible without this platform. THANK YOU BAJA!”





TRACTOR DESIGN COMPETITION

“A Dream is not what you see in your sleep, a Dream is something which doesn't let you sleep.” Grease, mud, glory is the dream that drives us to excellence every year.

It has been 2 years since SAE TKMCE has been participating in the Tractor Design Competition under the Southern Section. We, TEAM TRAKTE is a group of 25 students from different branches and semesters and our collective efforts propelled us to AIR 2 after the meticulous improvement of AIR 4 in the recent seasons.

SAE TDC is meant to design, engineer and prototype a 17 HP general purpose chassis based agricultural tractor with a potential use in the field of recreation, small farming and municipal use with a price tag of 2.7 lakh based on an annual sale of 20,000 units per year and demonstrate the same on a limited test track.

As the competition name suggests, the focus is centered around the design features and calculations. The design in turn, is documented by way of a complete manufacturing drawing of all the parts and assemblies; with individual costing and engineering materials, accompanied by a project report.

2017-18

STALLION - AIR 4 , Kerala 1st , Design - 3rd
Participation on this event was our very first

experience. Lack of prior knowledge or first hand experiences made the venture quite challenging for the team. Often, we even doubted whether we could complete such a wholesome automobile. Our dedication to the goal accompanied with months of perseverance helped us to give birth to our beast, STALLION.

Our skills were put to test at the competition site when the exhaust silencer guard caught fire and the brake bladder tore off. Sleepless nights at the camp finally made it possible to solve these issues and eventually we aced victory at AIR 4 and secured the 'State Topper' title. Additionally we won 3rd price for the Best Design Award. This was a great beginning and we started to believe in soaring even higher in our future seasons.



2018-19

TAURUS - AIR 2 , Kerala 1st , Design - 1st

We continued our legacy with our second beast – Taurus! A preexisting strong base played quite well to our advantage. Our Design Report was an outstanding piece of work which made us confident and proud that we were leading far ahead with the design report alone. We fabricated our own gear box housing, reduction box and front axle. Improvements and modifications to a strong base model made us capable enough to compete with anyone else.

Unexpectedly, a sudden burst of misfortune fell upon us. Just weeks before the competition, our engine underwent a failure. At the event site, our reduction box ceased to work and gears were slipped out. Due to constrained academic schedule, half our crew couldn't attend the event. Eventually we had to fight with half our crew but we successfully resolved each and every problem through confidence and commitment. AIR 2 was a successful culmination of our efforts. We maintained 'The State Topper' title from previous year. Additionally, we won the Best Design Award. Our Taurus proved to be one tough beast!

At present, we are working on the TDC 2019-20 event. We are glad to inform that we completed the first round workshop event with a good score. Our 'Design Report' has already been completed successfully. The team has always shown a strong commitment in completing a work at hand and has an undying thirst for novel ideas and innovations. We believe team spirit and passion is what unites us to work as parts of a whole.

We deal with Grease.

We deal with Mud.

We strive for Glory.

For Hooking & Pulling.

Tinto Thomas
TEAM TRAKTE
SAE TKMCE





FALCONS



SPITFIRE

AERO DESIGN CHALLENGE

SAEISS Aero Design Challenge competition is intended to provide undergraduate and graduate engineering students with a real-life engineering challenge. Each team is required to conceive, design and develop a prototype of fixed wing UAV, meeting the mission requirements. Students have to perform trade studies and compromise appropriately, to arrive at a design solution that will optimally meet the mission requirements while still conforming to the configuration limitations. The purpose of the SAEISS Aero Design Challenge is to promote and develop Indian expertise and experience in unmanned systems technologies at the university and college levels. Even small scale unmanned vehicles are complex systems requiring a well planned and executed design approach. In addition, safety considerations are important factors in this competition as in any other vehicle design project.

SAEISS Aero Design features two classes of competition - Regular and Micro. The purpose of Regular class is to develop the fundamental understanding of flight and the goal is to lift as much payload as possible. Micro Class teams are required to make trades between two potentially conflicting requirements,

carrying the highest payload fraction possible, while simultaneously pursuing the lowest empty weight possible. The competition also provides multiple opportunities for teams from all over India to showcase the extraordinary talents of engineering students while encouraging them to develop innovative ideas towards development of improved systems for UAVs.

Two teams participated in ADC 2020 from TKMCE- Team Falcon and Team Spitfire in the Micro category. Both the teams consisted of students of Mechanical Engineering Department of 2nd and 3rd years. Team Spitfire was led by Raghuram Ramanath and Team Falcon was led by Rohin K Rajeev. Four students from each team attended a training workshop held at St Peter's College of Engineering, Chennai in October 2019. All the essential details of aeromodelling were discussed at the workshop. Each team also assembled an airplane kit at the venue and it was flown in the final session. It was an amazing experience to see our models fly.

The final event of Aero Design Challenge, national level RC aircraft design competition was held at BIT, Coimbatore on 28th Feb to 1st March 2020. Both the teams successfully completed all the rounds.

Team Falcon secured 3rd position in Technical Presentation and obtained an overall ranking of 21 among 64 colleges of nationwide participation.

Having participated for two consecutive years, our teams have gained a lot of experience from this competition. It has helped us to gain more knowledge in the field of aerodynamics and also aided us to achieve some design and analytical skills. In this project, we applied principles of mathematics, science and engineering in order to analyze and design a radio controlled aircraft, from scratch, which matches the requirements established by the SAE for its Aero Design Competition.



Our team mainly focused on two potentially conflicting requirements, carrying the highest payload fraction possible, while simultaneously pursuing the lowest empty weight. The aircraft is expected to perform in such a way that it is capable of earning points at each level of the event. Through iterative analysis and modifications, we determined which characteristics were needed and which were not. Apart from this, our design also has a social perspective aimed at the field of agriculture. With the use of our UAV, agricultural workers can gather data, automate redundant



processes and generally maximize efficiency. Here, image processing along with effective communication network is used as an effective tool for analyzing various parameters. Analyzed parameters are more accurate and less time consuming as compared to traditional methods. Prof. Wazim was the mentor of our team.

It was a very momentous experience for all the team members. The event helped us to learn a lot. Not only did it give us technical knowledge but also helped us learn about the important aspects of being a team player and working towards a collective goal.



EFFICYCLE

Those 5 days left all of us with memories for a life time. During this period, it was not just our technical expertise that was tested but also our patience, perseverance and endurance. Each day, we thought that this was it, that this was the end of our journey but by the grace of God, we were able to solve each hurdle that hindered our path. On the first day we were forced to sit back, with our hands tied watching other teams perfecting their masterpieces as ours hadn't even arrived due to an issue with the logistics. We lost the entire day. Most of us didn't even sleep that night. Our captain, Vishnu was keenly working on bringing our vehicle at the earliest by the next day throughout the night. Meanwhile, our team (along with 13 other teams who sent their vehicles through the same logistics) were issued a memorandum stating that we must complete our first TI by 1pm the next day, failing which would have led to immediate disqualification from the event. This tensed us all up and we started losing our hearts, simply because we couldn't believe that all our hardworking would be dismissed just like that because of a logistics issue.

The cargo arrived at 10pm the next day and by this time, we had already lost a third of our total time at the event. As if all this torture wasn't enough, the logistics unloaded the cargo outside of LPU in the

highway stating difficulty in maneuvering the truck inside the campus. This might not have seemed a problem at first, however, before shipping we had disassembled our vehicle from its every unit and had sent the roll cage alone. This left us with two options; either we had to carry the 100 kg vehicle for about 3.5 km to our pit or assemble it on the highway itself. We chose the latter and did the necessary assemblage right there on the highway, brought it back to our pit, finalized the assembling and presented our craft to the judges for our first TI round. To our disbelief, the judges only pointed out 7 mistakes that could be corrected easily. We were joyous but it didn't last for long. By the time we brought the vehicle back to our pit, we realized that our shaft, which is the most crucial part of the machinery in our power train had suffered a bend. Whatever joy we had, left us immediately. Luckily we had brought with us enough material for an extra shaft. We then planned to drill it the next morning while the rest of us would work on those 7 mistakes listed out to us.

The next day, which was the third day into the competition, we executed the plan perfectly and were ahead of schedule. During the process we found out that one of our Plummer block was dysfunctional at the cost of incurring a small bend to our new shaft

even though not a serious one. We then completed our TI, static events, figure of 8 and electric drive test. We were also able to give 3 attempts on the Brake Test. We were positive that we would be able to successfully complete the Brake Test on the next day but another unprecedented issue struck us. The shaft showed a more pronounced bend along with a lack in speed, when we took it for trials. We were stranded with no solution as both the shafts had been expended. That was when our technical staff, Riyaz Sir, advised us to straighten the bend shaft by hammering using a wooden block. We tried this and were successful. We also went further and inserted a smaller shaft inside the main shaft and corked its ends. By then, we were all set for our braking test. On the last attempt, we cleared the Brake Test by a margin of 1.5m.



By the end of this round, we were the only team from Kerala that was still standing. We then went ahead and accomplished other more simpler tests without much effort and lined up for the last dynamic test which was the Drive Excellence. This was where things started to go downhill. We had to steer our vehicle through a number of hard turns, potholes, narrow roads, wedges and through a water spray zone. This was when our electric drive suffered a major blow as some water went inside the circuits and shorted it. As a consequence of this, the next day for the Endurance Race, we had to drive the vehicle on mechanical drive alone which seemed highly resilient to any setbacks.



We completed 7.5 laps of 2km each within the time allotted to us. This was a feat never achieved by any Kerala team in the 10-year long history of SAE Efficiency and we are proud to be part of the team that brought this glory to TKMCE.





BRAKES & WHEELS

The story of our ups and downs XLR8 FORMULA STUDENT TEAM

“ The winner ain't the one with the fastest car. It's the one who refuses to lose”

These words by Dale Earnhardt has kept us going, no matter how many times we stumbled and fell.

This is the story of XLR8 Formula student team of TKM College of Engineering. It did not bloom overnight like a fancy dream, but evolved from the sweat and passion of few student automotive enthusiasts who put their “nuts and bolts” into formula racing.

The garage of TKM has a great legacy; despite winning at many of the prestigious competitions like SAE-BAJA, SAE-TRAKTE, but it took till 2019 for TKM to put forth her first race car MACH.1.0. The idea of building a race car had been there in the minds of our seniors right from the start of the competition SAE-SUPRA, but the budget, complexity in design and electrical configuration made them think that it is unachievable. In 2017 some students of 2nd year Mechanical Engineering came together with the intention to make their first race car intended to hit the competition SAE-SUPRA 2019. The idea was put forth by Mohamed Eza and was backed by a dedicated team of like minded students- Jaikrishnan, Athul Rahul, Jithin KV, GK Abhinand and Jeslin John. Fortunately many of them had experience working at

teams like efficycle and baja. The idea soon gained traction among our seniors as well as faculty, and with that spirit, our first team was formed.

Even as the team was taking it's baby steps, Prof. Ahammad Vazim of the Mechanical Engineering Department, offered a helping hand in organising ourselves into a functional team. Our faculty advisor Prof. Faraz P Junaid never failed to encourage and support the team right from the days of brainstorming. Special mention has to be made of professors Aju Kumar V N and Syed Muhammed Fahd for their help in providing all the technical knowhow necessary to build a race car.

We began our work with buying an old Duke 390 cc engine. Challenges are inevitable part of success, and our next challenge was the availability of parts and a person with technical expertise for assistance. Mr. Rajesh of Sarathy Automobiles helped us a lot financially as well as by providing us with the required parts. He is a good motivator who provided us with the required practical knowledge and proved to be the game changer. The next problem was with the engine when it simply failed to start. This problem was fixed



with the persistent efforts of the team led by the service manager of KTM Kollam, Mr. Jijo who was more like a brother to us. He was always there to help us. All the hardships were overcome by sheer hard work and perseverance of team members. Yes, MACH.1.0 became a reality. After a few trial runs we were able to go for our first venture: SAE-SUPRA 2019.

SAE-SUPRA 2019

SAE-SUPRA is India's biggest formula student competition, organised by the Society of Automotive Engineers India (SAEINDIA), the strategic alliance partner of SAE INTERNATIONAL registered in India with the support of Maruti Suzuki. The event is held annually at the formula 1 track at Buddh International Circuit, Greater Noida (Uttar Pradesh). The event is a platform for students to apply their engineering skills to design and construct a formula category vehicle as per defined performance and safety specifications. SUPRA comprises a series of static as well as dynamic events spread over a span of five days, concluding with a final endurance run.

The competition began on 15th July 2019, and the intensity of the events first put our morale rather down; but we tried to make the best of it. At the Technical Inspection level itself some unforeseen errors were listed by the coordinators, and everyone in the team sweated out their last drop and hopefully corrected the errors for the next Technical Inspection (TI). Then an altogether new set of issues cropped up, the fixing of which was well beyond our capacity. So we decided to go for static events- the design, cost and business presentations.

The competition gave us new insights and made us realise what should be the ultimate aim of being an engineer of the 21st century. Everyone utilised the platform to understand more about race cars from other teams with a hope to improve in the future competitions. The judges were really satisfied with our first race car venture as it was upto the standard of a first generation formula student car. Even though our overall ranking was a distant 90 among a total of 120 teams, it was a pretty good result for us beginners- as we were able to make a C car from the amateur team just as design judge for FSAE Claude Rouelle said. With the experience and knowledge gained we

decided to go ahead with our next generation car MACH.2.0.

In January 2019, during the design phase of MACH 2.0 some of our teammates went to visit Formula Bharat 2019, another formula student competition held at Kari Motor Speed Race Track, Coimbatore and decided to participate in that event. Right after SUPRA 2019, the team registered for Formula Bharat 2020. We only had six months left for Formula Bharat 2020, but still had faith and optimism propelling us. By taking the majority of the parts of MACH 1.0 and rebuilding the chassis, we built our next race car- MACH 2.0. The work was much more focused as a result of the past experience, still again the paucity of sponsors was the real glitch and so we had to cut the corners. Even though we had a rather short span of six months, we could ensure its timely completion and could salvage one week of testing MACH 2.0.

FORMULA BHARAT 2020

Formula Bharat is an engineering design competition in which students from colleges and universities all over the country compete with a life-size formula style vehicle in areas of engineering design, overall cost, marketability and dynamic performance. The series replicates the global student formula series hosted in around 11 countries per year.

The turnout at Formula Bharat is low compared to that of SUPRA, and one reason being international level of standards. We were the only team from Kerala to bring the vehicle for the competition. The cars we saw over there were professional and had reputed sponsors in each necessary field. On reaching Kari Motor Speed Race Track on January 22nd everyone put in their maximum effort to resolve some of the technical snags on transit and reached the technical inspection level by evening. The very next day we took the car for the Technical Inspection, but failed to clear the TI as many 'out of the rulebook issues' were asked to be cleared on, and the same was not possible within the stipulated time frame. But just as always we did hold our spirits high and used it as an opportunity to

have some first rate exposure advantage. We earnestly believe that we did an appreciable task as an amateur formula student team with obvious time and resource constraints, and everyone was happy with our results of AIR 32 in cost presentation, AIR 33 in design presentation, AIR 39 in business presentation and an overall rank 41 among 80 teams. We as a team have done our best within the limitations set upon us, and we all hope to raise our standards with MACH 3.0, aimed for Formula Bharat 2021. There are a lot of challenges that we still need to sort out and one main issue being the lack of sponsorship.

“Rome was not built in a day”. Like that we cannot pull out a top level car out of the blue. ‘Strive, seek and not to yield’, which is the legacy of TKM will be kept intact, we promise.

Emil Manuel

M4A

TKM College of Engineering Kollam

SAE TIER EVENTS

Dreams come in a size too big so that we may grow into them. The Tier events conducted as a part of SAE Student Convention is one of those rare events that mould a student restricted by the boundaries of a classroom to an engineer who uses what he knows to enhance practical skills, explore and empower. These events focus on not just the technical aspects but also provides a platform for overall development.

About 50 Tier 1 events are held at the college level. The events doesn't just include mechanical stream but also various other streams like electronics, electrical and computer science. The Tier 1 events are aimed for an exposure into the practical side. TKM has been holding the Tier 1 events for the past few years. Tier 1 does not mandate the participants to be a member of SAE. The participants are awarded with participation certificates and university credits. The winners will qualify for the Tier 2 events to be conducted at state level.

The Tier 2 participants are also awarded with participation certificates. These certificates are an extra feather in the hat when it comes to placements. TKM has conducted phase I of Tier 2 for the past two years. TKM has always proven to be the best when it comes to conduction of these events. The smooth conduction



of Tier 2 events is due to the immense hardwork and teamwork put forward by the students. The results are always unbiased and the best are always recognized.

Further qualification leads to competing in Tier 3 events that is held at national level.

The Tier winners are given a chance to exploit their talents further as they get a lot of exposure, connections and contacts with the best professionals from all over the country. SAE Tier Events are a testament to the fact that sleepless nights, immense hardwork and most of all, teamwork will make any dream come true under good guidance.





SAE INDIVIDUAL ACHIEVEMENTS

The 13th SAEISS National Student Convention 2019 was held at Bannari Amman Institute of Technology, Erode on the 23rd and 24th March 2019. The competition consisted of more than 30+ technical events and a few surprise events where students from all over the engineering colleges in the SAE Southern Section have participated.

The following students of TKMCE bagged prizes in the respective competitions:

CFD Contest- 2nd Prize

Athul Krishnan (M8)

Tom Baby (M8)

How Things Work-2nd Prize

Jishnu G Nair (M6)

Asnaf K (M6)

Modelling and Animation -2nd Prize

Navaneeth N Sajan (M6)

Linjo Rejoy (M6)

Bicycle Assembly and Maintenance-2nd Prize

Rohin K Rajeev (M4)

Jayasoorya (M4)

Mithun M Nair (M4)



ASME REPORTS



ASME EXECUTIVE COMMITTEE 2019-20



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Adilsha Kizhuvedath
Vice-Chairman



Amal S
Treasurer



Sayuj Jayadev
Technical Head



Arun M S
Media and Publicity Head



Athul T P
Design and Documentation



Niranjana M T
Membership Head



Nikhil S
Student Co-ordinator



Nithin N P
Student Co-ordinator



ASME E-FEST 2020

Marwadi University

An iridescent canopy awaits us opening on to the imposing facade of the structure of the veritable campus with the many vibrant hues of new vistas unfold before the competitors assembled

After a brief and unexpected sojourn at Rajkot station, a frivolous bout of fretting ensues for we have arrived a good 3 hours early on this eventful morning with an overcast sky off we cruise through the mist to our much awaited destination ' Marwadi University', where each team after a brief respite leaves the group as our seniors watch on ruefully just as a mother nudges off its baby Birds from its habitual haven emanating pride tinged with venial vanity.

27th February time 5:30 p.m venue:Jury stand HPVC

A strenuous saga to describe, it is ineffable, I am filled with emotions as I rhapsodize through the challenging levels of safety inspection , crestfallen was I after the presentation for it was all in tatters, with the jury unrelenting.

28 February 10:00 a.m Campus premises I am 3D

Nithin with his team

rush the initial bouts of technical audit with ease, helping their fellow opponents out of a rigmarole which proved fateful

Prennoy: *"that was a piece of cake "*.

28 February time 10:00 a.m venue campus premises Aeromania

The neophytes jatayu and Dharma with a palpitating heart set off for their trials and effortlessly sail past the technical scrutiny with their impeccable models

28 February time 4:30 p.m. venue the playground

They regrettably fall short of set standards during the final showdown.

Hardik :*" I am confused as to what caused that fatal dip of our plane in mid air".*

RS Balaji:*" Never mind we will be back with more zeal".*

29th February venue race course Time 10:00 a.m.
HPVC

Redoubtable sprint with Asna succumbing to sore distress and Basil's intervention
Basil- "*girl you've got this.*"

Avinash- "*get your stuff together now the ramp is all yours.*"

In a floundering Frenzy she takes off, yes takes off to garrulous gumption and applause amid riotous cheers from onlookers as she earns a staggering fifth on the scoreboard.

Its serendipity perhaps, as all of us are awestruck but subsequent biased trials rendered this feat filled with frisson down to the tenth position.

Now close behind the trail the boys blustering like wind secure good spots.

29th February time 5:00 p.m venue campus premises
I am 3D

Braving the scorching sun where it beats down like hammer they stand.

Prennoy: "*duck now , hard left straight here, right there you have lost it*".

After a close call in the semis they falter, valor giving in to fate, almost tasting success.

29th February time 4:00 p.m. venue campus premises
Biomimicry

Impromptu decision leads our seniors to the threshold of the bio mimicry challenge.

Athul- "*there goes my Idea don't know about its authenticity but that's got to get the job done.*"

1st March time 9:00 a.m. HPVC

Aaron- "*I picked up the parcel, I got it*".

Basil: "*seems like the chain is undone fix it quick.*"

Nikhil: "*well, we've braved the tempest good job guys, I am proud of you all.*"



TEAM DHARMA & JATAYU



TEAM AETHER

Through the tortuous Salem course, undulating terrains have we all trudged along to emerge as victors.

Through escarpments we have glided through hurdled erect and aplomb subversive to all unjust reprimands, savoring the sweet success of a surprising seventh soaring on the scoreboard

Rahul Raj

Mechanical 3 year

ASME TKMCE ACTIVITIES 19-20

1. E Fest 2019:

Date: 1-3 February 2019

• Student Design Challenge:

Team Optimus flaunts their archetypical model through the initial levels of safety and technical inspection and sail through to the knockout round.

Athul: *“It was a tough fight we have proved our mettle.”*



• IAM3D:

Team Sedna blaze through the technical audits and reached till the finals.

Nithin: *“The whole contest is a big joke”*



• Biomimicry:

Students who attended workshops and talks on Bio mimicry and 3D printing, won many prizes including an Amazon Echo and gift coupons.

“It was one hell of an experience!”



- **Aeromania:**

Teams Nandini, Falcon and Hawk soar high with Nandini securing a coveted third.

Afsal: *“An engineering Experience”*



Team Nandini



Team Hawk



Team Falcon

2. Orientation programme for freshmen:

Date: 18 March 2019, Venue: TKMCE

A pleasant and plenary meeting where hopes fly high divulging initial foreboding as the college warmly welcomes its newest initiates.

Freshman: *“This was certainly a pretty congenial meeting, unlike what we feared it would be”*



3. Freshmen Recruitment:

Date: 18 March 2019

120 freshman appear for initial screening test from which 45 were selected. From these, 15 were selected after the last round.

Freshman: *"The tests were a bit hard to crack"*



4. Student Development Programme:

A novel initiative by ASME TKMCE chapter where seniors impart their technical expertise of design software.

"That was indeed a technical revelation"



5. EFX MBCET:

Date: 12.10.2019 Venue: MBCET

Exclusively designed to foster increases innovation and technical expertise through contests like treasure hunt, debate, etc

Prennoid: *“Food for thought was only taken care of.”*

TKMCE students won all three prizes for the Out of the Box Design Challenge and prizes in other events such as treasure hunt, Debate etc.



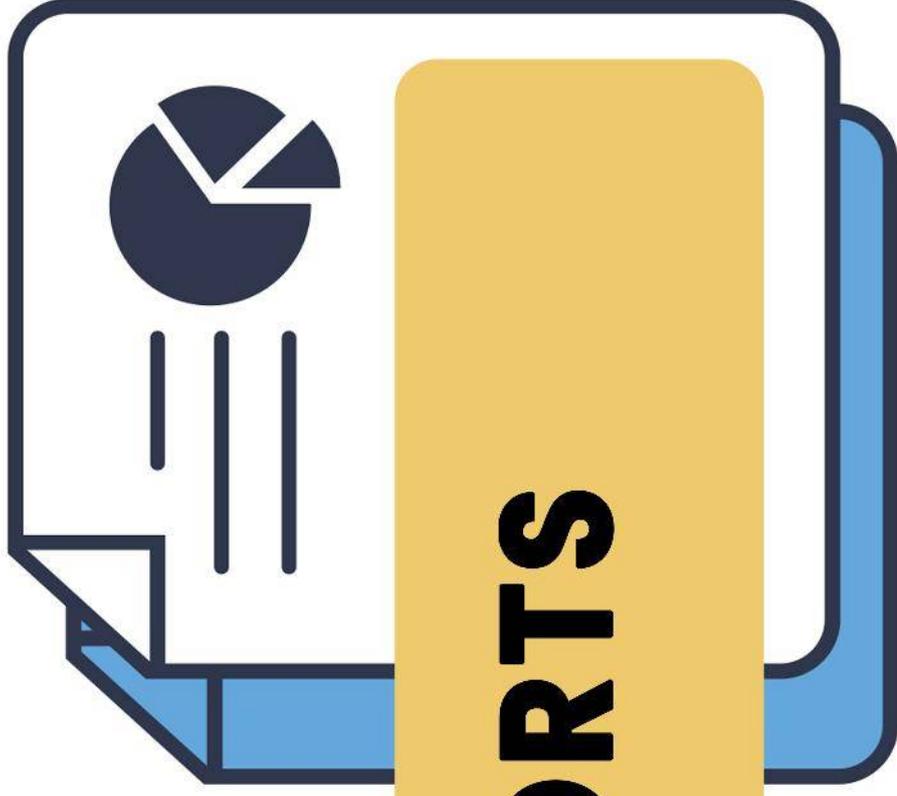
6. University Mars Rover Challenge:

An upcoming challenge comprising of four events where students prove their prowess.

The Mars Society's University Rover Challenge challenges students to build remotely operated rovers that can accomplish a variety of tasks that might one-day assist astronauts working on the surface of Mars.



IEI REPORTS



IEI EXECUTIVE COMMITTEE 2019-20

Mechanical Chapter 2019-20



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Chairman



Sreerag C.
Vice-Chairman



Sreejith T.
Secretary



Neeraj Kumar P.
Treasurer



Sarath Nadh M.
4th Year Representative

Mechanical Production Chapter 2019-20



Anandhu Anil
Chairman



Akhila L.
Vice Chairperson



Mathias Binoson
Secretary



Bipin Ravindran
Treasurer



Dheeraj K. Panicker
4th Year Representative

IEI TKMCE ACTIVITIES 19-20

1. Expert Lecture on “TURBINE INSTALLATION IN POWER PLANTS” By Er. Bindu Natesan

Date: 26 February 2019

The Institution of Engineers (India), Kollam Local Centre and IEI Mechanical student chapter TKMCE, Kollam jointly arranged an expert lecture on the topic “Turbine Installation in Power Plants”. On the inauguration of the program Dr.S.Jose, Professor Mechanical Engineering and former Secretary IEI Kollam Local Center welcomed all and had given an outline about the program and importance of the topic.

The Chief Guest, Er.Bindu Natesan, former project manager Alstom gave an expert lecture on “Turbine Installation in Power Plants”. He urged the student community to come forward to study about the practical aspect of turbine installation in power plants. He also emphasized on the project management approach to be followed by young engineers to propel forward in their career.

The detailed session started with presentation on Gas Turbines. All the segments related to power generation were explained in detail with focus on exploded part drawings with animations. The second part of the session dealt with Steam turbines with a nice presentation using working animations of each part. Finally the session concluded with Co-generation aspect of power generation using a detailed layout design with animations.

Er. Bindu Natesan shared his thoughts and vivid experience on power plant setup, installation and commissioning and the role of engineers and managers in this aspect. He also had a discussion with students on career aspects in these industries. The session ended with Q&A session followed by vote of thanks by student representative Mr. Anand Anil Kumar, Final year student.



2. Short Term Training Programme on “ MEP SERVICES”

Date: 10-13 October 2019 to 17-20 October 2019

The Institution of Engineers (India), Kollam Local Centre and IEI Mechanical production student chapter TKMCE, Kollam jointly arranged a Short Term Training Programme on “MEP SERVICES”. On the inauguration of the program Dr. Mohammed Sajid N.K., Professor & HOD Mechanical Engineering welcomed all and had given an outline about the program and importance of the on-job training programmes. He also gave a brief idea of job opportunities in MEP & HVAC sector in India and abroad.

Er. Nidhin Sulaiman, chief trainer Capitol professional academy gave an introductory session to the STTP. He shared his vivid experience in various projects with the students. He urged the student community to come forward to get trained in these types of skill and technology enhancement short term courses. He also emphasized on these types of STTP in getting a campus placement in the modern scenario of job market. The detailed session started immediately after the inauguration and introductory session. Practical sessions were held at Central computing facility after each

theory session in PTA Hall. The programme was conducted in two batches to accommodate 96 participants out of which half of the participants IEI student members.



The STTP concluded on the 20th Oct 2019, the last day of the second schedule with valedictory function and students' feedback. Mr. Athul T.P., Final year representative Mechanical student chapter gave vote of thanks to the gathering. Certificates for the same are also distributed on the same day.

3. Workshop on Introduction to C++

Date: 23-24 November 2019

The Institution of Engineers (India), Kollam Local Centre and IEI Mechanical production student chapter TKMCE, Kollam jointly arranged a two day workshop on C++ On the inauguration of the program Dr. Mohammed Sajid N.K., Professor & HOD Mechanical Engineering welcomed all and had given an outline about the program and importance of the topic. The Trainer, Er. Sumod Sunder gave an introductory session to the workshop. He urged the student community to come forward to study about the different programming languages. He also emphasized on knowing at least one programming language to get an campus placement in the modern scenario of job market.

The detailed session started immediately after the inauguration and introductory session. Practical sessions

were included after each session. The second also continued with same format..

The second day session ended with Q&A session followed by vote of thanks by student representative Mr. Anandhu Anil, Final year student.

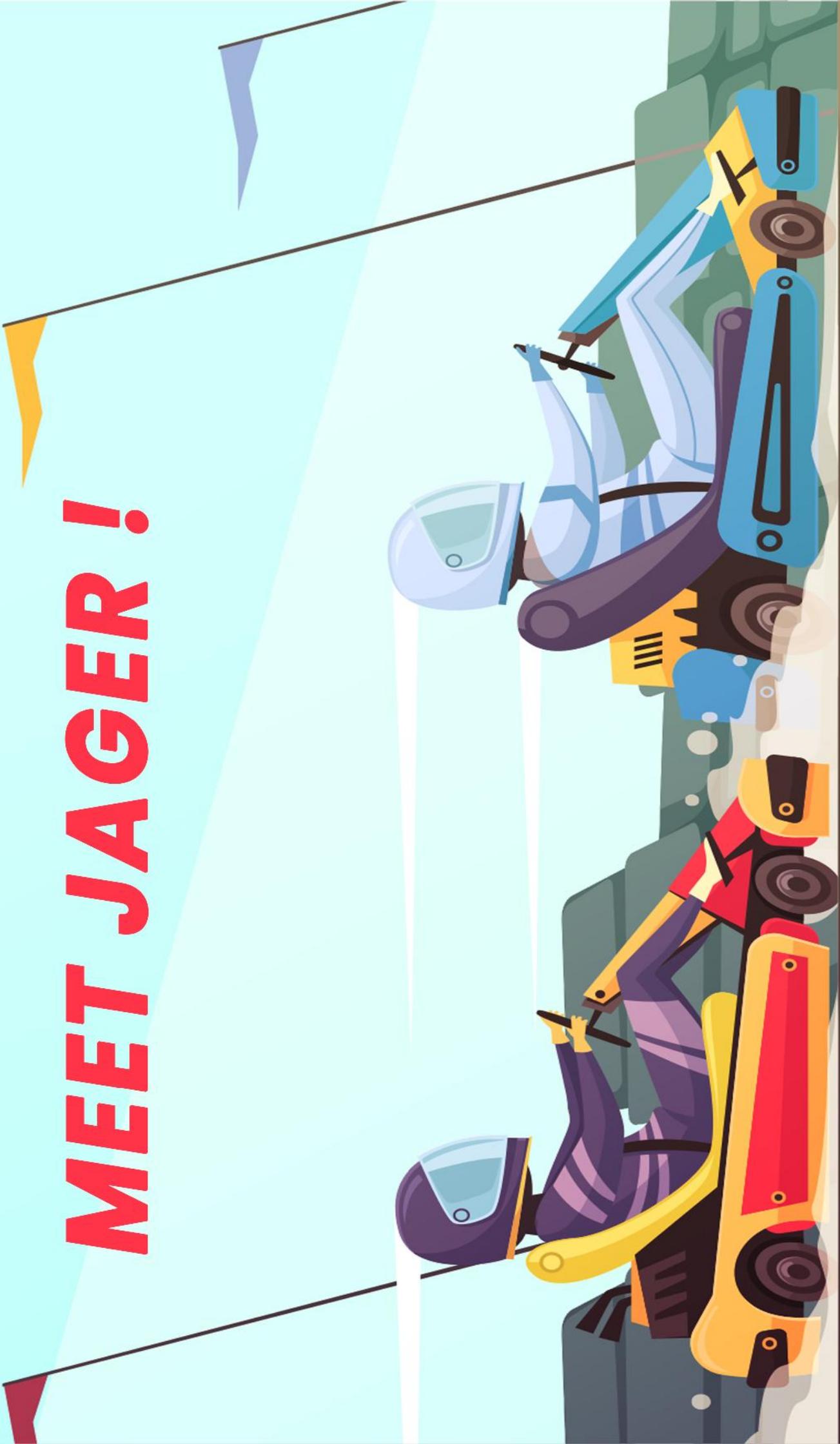


4. Industrial Visit in Oil Palm India Limited at Yeroor, Anchal, Kollam

Date: 22 February 2020

The Institution of Engineers (India) (IEI), Kollam local branch organized the Industrial Visit. Mr. Jayachandran, the former Manager of Oil Palm India Limited was the I V in charge, Mr. Sumesh, The Executive of IEI Kollam branch assisted him and Mr. Praveen of Final Year Mechanical Engineering TKMCE was I V coordinator. The main process done in the Industry is the extraction of Crude Palm oil and Kernel Oil. The raw material for this extraction process is from Oil Palm Fruitlet and they had its cultivation in about 10,000 hectares. The crude Palm oil is extracted from the mesocarp of the fruitlet and kernel oil from its seed. The Palm Oil is used for edible purposes and kernel oil for manufacturing of cosmetics. The manufacturing of this crude oil is completely a mechanical extraction process and they are using Italian Technology for this.

MEET JAGER !





Electric vehicles are becoming increasingly popular in our lives, especially in motorsport. However, they are not widely used. Formula E, which was created to boost electric motorsport, is not enough to popularize it. Every driver who wants to advance to F1, which is the highest in rank racing series, has to start from karting. EKarts offers a similar performance to combustion engine go-karts.

JÄGER racing team, one of the prominent clubs of TKMCE provides a person with the finest knowledge and an abundant practical experience in Ekart, by making it from scratch to racing it on track. The team consists of 30 highly skilled and talented members selected from different engineering departments. The "RED BEAST" wouldn't have become a dream come true without the selfless dedication and hard work of the senior team members who helped their fellow juniors to learn and understand the various concepts and things.

The idea of jager was put forward by few passout students who were inspired by the famous Praga Kart Racing team. The first kart was born out of the selfless hard work, perseverance, dedication and sacrifice put together by each member of the team. It's the immeasurable love towards the dream and the quench for

success that made them cross the up's and downs in their path. The tremendous support from the experienced faculties of our mechanical and electrical department was crucial in our efforts. This was how the journey of Jäger Racing team was started in TKM College of Engineering. As said, great dreams of great dreamers are transcended, the dream of the passouts was passed to the next generation and hence the revolutionary "RED BEAST" came to being.

The team members were highly committed to the work that was assigned to them hence no matter which part of time it was, the whole team was more than ready to give their best regardless of the outcome. Team Jäger followed innovative approaches for each and every aspect of the vehicle. Utmost importance was given to the safety of the driver hence every calculation was carried out with extreme care. Even while giving importance to safety, team Jäger doesn't compensate with the aesthetics. The team secured AIR 2nd for aesthetics in 2020 National E-Kart Championship.

One of the greatest achievement of the team is the consistency in performing well in large events despite the tough circumstances.

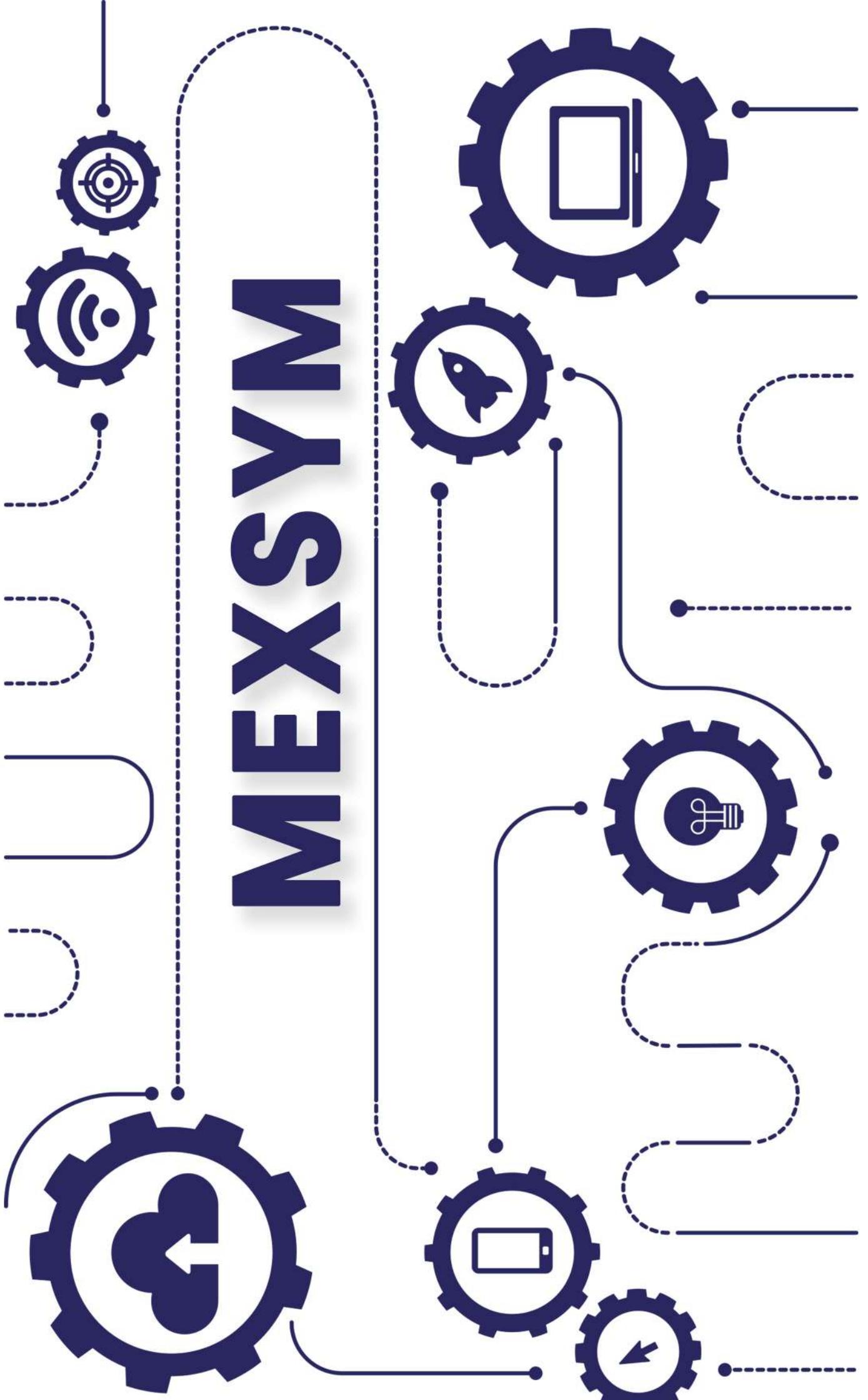


There were testing times when there was shortage of necessary material and work delays took place. But they were all successfully overcome by the helping hand provided by the team members to one another. It's the immeasurable love towards the dream and the quench for success that made them achieve their dreams



Since the kart is powered by an electric power source it is highly beneficial for reducing emissions of greenhouse gases. The future of the automotive industry is highly reliant on alternative sources of energy and thus, Ekart is something that has a high scope for the future.

MEXSYM



MEXSYM

MECHANICAL ENGINEERING DEPARTMENT

This year the Hestia 20 transformed the minds of the students to that of a grease monkey and etched into our lives as the book of fruitful experience. It traversed over 4 days from March 5 to March 8 2020. The stall was named MEXYM. The stall comprised many outstanding projects like Wall Climbing robot, Artificial PVC canon, Electric scooter, Electric hoverbord, etc...

SAE and ASME TKMCE being the two most active chapters in the college had went for various competitions and secured high position in them. The numerous works of them work exhibited in the Mechanical stall and the Mech corner, situated in front of the department.

The various projects that were exhibited in the stall were made by first year Mechanical & Mechanical Production students. They were guided by Association Secretaries Mathias Binson and Jishnu G Nair(4th Year mechanical). The Main coordinator was Sayuj Jayadev(4th Year mechanical). There were four stalls in total of which one was a gaming stall which was coordinated by Shazaman(4th Year mechanical). A corner in the memory of former principal MKA Hameed was set up in the stall by Megha Nandan (1st Year mechanical). A workshop on Biped Robotics and various competition like RoboWar, How things work, Junkyard War, Cad War, were conducted by Mechanical Department during Hestia 20.

WALL CLIMBING ROBOT

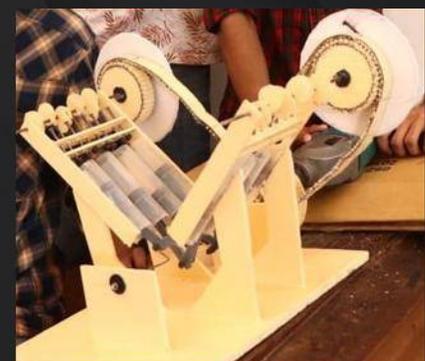
Building a robot which clings onto the wall, and could be driven there, was our aim. Here we made an 8'x10' model out of strong light weight material and make use of suction power to help overcome gravitational pull.

A high power brushless motor gives the propeller a great speed of 10,000 rpm. A suction column is created using Styrofoam and is given a cycle tyre tube lining. This helps create a very low pressure air region along the wall, which helps the robot to stay firm at the wall. Two geared motors and wide wheels are used to get a good grip on the wall. The climber is controlled by Bluetooth via an Arduino. Although it should be accepted that the efficiency of such vacuum powered climbers are low, as it takes enormous amount of power compared to the net weight. Work to make mcient models are going on.



V8 ENGINE MODEL

A V8 engine is an eight-cylinder piston engine in which the cylinders share a common crankshaft and are arranged in a V configuration. A model demonstrating the working of V8 engine was built and showcased at the Mechanical Stall.



ARDUINO CNC DRAWING MACHINE

Arduino CNC Drawing Machine is a CNC based drawing robot. It is open source and open hardware project. It uses Arduino UNO (Atmega328p) as the brain of the robot and a special GRBL firmware for G-Code Interpretation and motion control. It also uses a Core [X, Y] or H-Bot Cartesian movement to control both X and Y axis. The Z axis is controlled by a servo motor to lift pen up and down. [CoreXY and H-Bot are Different. CoreXY has better performance and accuracy than H-Bot]

This Arduino Drawing Machine is capable of writing or drawing on almost any flat surface. It can write with gel pens, permanent markers, and a variety of other writing implements to handle an endless number of applications.

Suggested applications of Arduino CNC Drawing Machine include:

- Decoration Drawing
- Computer artwork
- Technical drawing
- Notes and cards
- Writing signatures
- Signing diplomas and other certificates
- “Hand-written” lists

HYDRAULIC PRESS

A Hydraulic press is a machine press using a hydraulic cylinder to generate compressive force . It uses the hydraulic equivalent of a mechanical lever.

Main Principle

The Hydraulic press works by Pascal's principle ie, the pressure through a closed system is a constant. A part of the system is a piston acting as a pump with a modest mechanical force acting on a small cross sectional area; the other part is a piston with a larger area which generates a correspondingly large mechanical force. A small effort force acting on the small piston creates pressure, which is transferred through the hydraulic fluid to exert a greater force on the large piston.

Applications

1. Forging
2. Clinching
3. moulding
4. blanking
5. punching
6. deep drawing
7. Metal forming operations

MAXWELL' s WHEEL

As a part of our techno cultural fest Hestia, our Mechanical and Production department had a technical expo. Maxwells wheel was one among them. The principle of Maxwell's wheel is that it investigate conservation of mechanical energy and momentum. Our wheel rolls to the top by means of string wound on its axle, then turns potential energy into kinetic and rolls back down. At the bottom, kinetic energy is converted into potential and the wheel rolls upward again. In an ideal world this would continue forever, but friction eventually sets in and the wheel will stop.



ELECTRIC SCOOTER

We, a group of first year mechanical engineering students, as a part of our college Techfest 'HESTIA', designed and created an Electric Scooter. It was an innovative idea bloomed from the minds of our team. We have used 1016z, 24 volt, 250w dc motor, having an RPM 3850, suitable for forward and reverse operations. The body frame work consists of square tubes and the standing platform as well as the bottom of the framework is supported by thin plywood sheets. The plywood sheet has been separated into 3 sections. The portion near the handle bar is the standing platform, the middle portion is constructed as a retractable door so that the electronic components can be stored in the hollow cavity between top and bottom sheets. The front portion of the scooter was extracted from an old cycle whose handle-wheel attachments were detached from its rest of the body by an industrial cutter.

A hollow cylindrical steel pipe was used for the extension of the handle and a regular cycle handle bar was attached. Also, two wheels from a small cycle too was extracted for the front and back wheels. The third plywood sheet is used to create a slot for the motor section. The motor is arrested on the steel framework through this slot, in alignment with the free wheel of the back wheel. A cycle chain of suitable length is used to link the motor and the free wheel.

A controller unit is utilized for a multipurpose electric actions. We have used an accelerator at the handle bar which is connected to the motor through the controller unit. Also, there is a light indicated accelerometer and a horn at the handle bar as well as brake lights controlled by the controller unit. The power supply of 24volts is supplied by a Lithium Polymer battery through the same unit. The whole system is initiated by a key mechanism, that mimics a real life scooter. Brakes are fixed for the front and back wheels similar to that of a regular bicycle.

This model of Electric Scooter will be very useful in Colleges, Schools and Offices for the easy movement of students, staffs, faculties, etc within the premises. Also, it will be a boon for hostellers who have to walk a good distance from the hostel to their campuses, as it reduces effort and saves time. It can support almost 120-130kg at a time and can run for more than 45minutes. It is easy to recharge and use again. In case of any breakdown, it can be easily moved by ourself as it is light weight. These are the benefits that can be manifested from our project.



BLENDING WING AIRCRAFT

A blended wing body (BWB), Blended body or Hybrid Wing Body (HWB) is a fixed-wing aircraft having no clear dividing line between the wings and the main body of the craft. The aircraft has distinct wing and body structures, which are smoothly blended together with no clear dividing line. This contrasts with a flying wing, which has no distinct fuselage. A BWB design may or may not be tailless. The main advantage of the BWB is to reduce wetted area and the accompanying form drag associated with a conventional wing-body junction. It may also be given a wide airfoil-shaped body, allowing the entire craft to generate lift and thus reducing the size and drag of the wings.



HYDRAULIC CAR

Slider-crank mechanism converts linear motion into circular motion. To rotate the wheels, syringes are used as linearly moving sliders by applying hydraulic pressure from another pair of syringes. The cranks are connected to each wheel at 90° phase difference to synchronise the to and fro motion of sliders for unidirectional motion.

Here, To rotate the wheels, syringes are used as linearly moving sliders by applying hydraulic pressure from another pair of syringes creating a hydraulic system. The hydraulic system works on the principle of Pascal's law which says that the pressure in an enclosed fluid is uniform in all the directions. The cranks are connected to each wheel at 90° phase difference to synchronise the to and fro motion of sliders for unidirectional motion.



HYDRAULIC RAM PUMP

A hydraulic ram is a water pump powered by hydropower. In areas where natural flows exist with a height difference of the water over a small distance, hydraulic ram pumps can be used to transport water to higher grounds without using electricity or fuel.

Principle

It uses the momentum of a relatively large amount of moving water to pump a relatively small amount of water uphill.

Advantages

- *No Electricity or External Power Source
- *Continual Operation
- *Easy to Maintain
- *Long Life
- *Reliable



ARTIFICIAL PVC CANNON

We made an artificial cannon with a combustion chamber. The gun was easy to make and seemed to make a loud voice.

To fire a shot, press the gas lighter. The resulting spark along with the alcohol in the body spray creates a force which will push the newspaper balls out with a loud noise.

This requires a 2.5-inch diameter PVC pipe of 1ft long. Close one side with a dummy and reduce the other side's opening to 1.5 inches. Then make a small hole in the middle of the dummy, insert a gas lighter into it and stick it with m-seal. On the other side, insert another PVC pipe, which has a 1.5-inch opening, through the 1.5-inch opening. Inside the 1.5-inch wide pipe, make paper balls using old newspaper, stuff it into one side and close it tightly.



PERSPECTIVE ART LOGO INSTALLATION

Installation is a three-dimensional visual artwork, often created for a specific place and designed to change the perception of space. It makes use of the off-field, a dimension that is not immediately visible to the person who is watching and was put into work aimed at effective waste management. A bunch of everyday used items became detrimental in bringing life to this perspective art form which was the logo installation. All the required materials are collected from college junkyard and nearby shops. The new mechanical production logo was brought to life using used plastic bottles and paint cans. The intricate design of the logo consisting of a piston with wings attracted everyone's attention and appreciation at the fest.

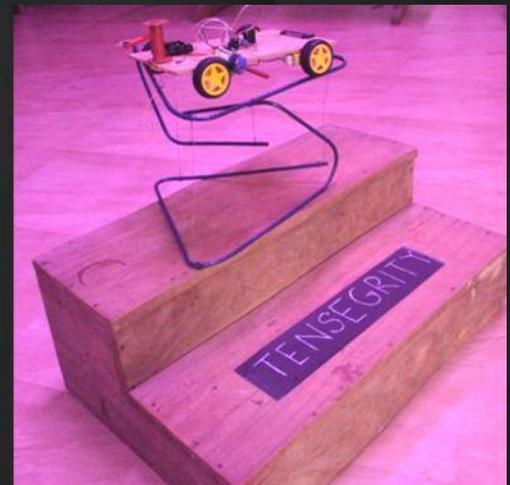


TENSEGRITY

Tensegrity is a design principle that applies when a discontinuous set of compression elements is opposed and balanced by a continuous tensile force, thereby creating an internal prestress that stabilizes the entire structure.

The qualities of the tensegrity structures, which make the technology attractive for human use, are their resilience and ability to use material in a very economical way.

Thus it was selected as one of the models in the expo.



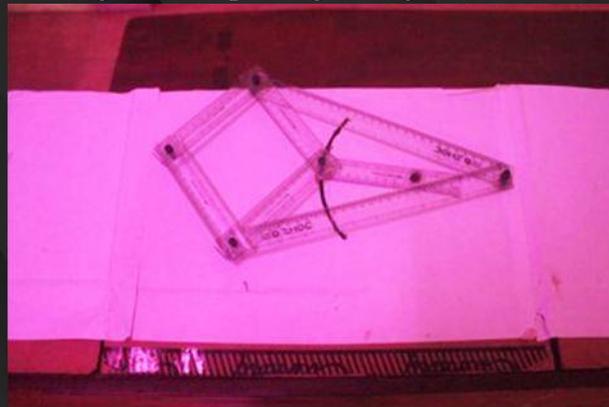
PEAUCELLIER MECHANISM

The Peaucellier–Lipkin linkage (or Peaucellier–Lipkin cell, or Peaucellier–Lipkin inversor), invented in 1864, was the first true planar straight line mechanism – the first planar linkage capable of transforming rotary motion into perfect straight-line motion, and vice versa.

Until this invention, no planar method existed of converting exact straight-line motion to circular motion, without reference guideways. In 1864, all power came from steam engines, which had a piston moving in a straight-line up and down a cylinder. This piston needed to keep a good seal with the cylinder in order to retain the driving medium, and not lose energy efficiency due to leaks. The piston does this by remaining perpendicular to the axis of the cylinder, retaining its straight-line motion. Converting the straight-line motion of the piston into circular motion was of critical importance. Most, if not all, applications of these steam engines, were rotary.

The mathematics of the Peaucellier–Lipkin linkage is directly related to the inversion of a circle.

In the geometric diagram of the apparatus, six bars of fixed length can be seen: OA, OC, AB, BC, CD, DA. The length of OA is equal to the length of OC, and the lengths of AB, BC, CD, and DA are all equal forming a rhombus. Also, point O is fixed. Then, if point B is constrained to move along a circle (shown in red) which passes through O, then point D will necessarily have to move along a straight line (shown in blue). On the other hand, if point B were constrained to move along a line (not passing through O), then point D would necessarily have to move along a circle (passing through O).



INVISIBLE HESTIA

The concept of Invisible Hestia shows that the absence of something could be art. The sculpture had been made from a series of layers of polished stainless steel that was then fit together creating a semi visible sculpture of Hestia. They can be visible and able to be appreciated, but cannot be seen by precision scientific instruments. These works present a paradox in the concepts of space, light, radiation, art and science etc.



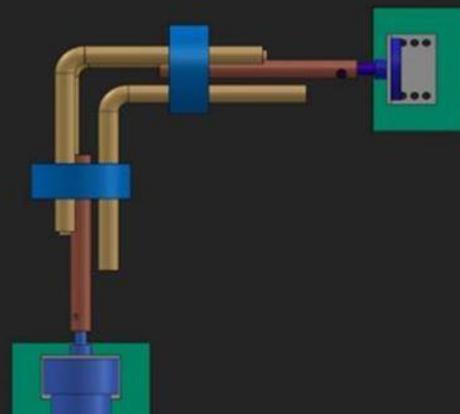
GEARLESS TRANSMISSION

This system demonstrates efficient gearless transmission of power at any required angle. This saves gear manufacturing time and costs along with teeth matching and gear placement issues. The elbow mechanism is an efficient design of gearless transmission technique and the kinematic system that allows for efficient power/motion transmission at any required angle. This mechanism allows for motion transmission from 90 degree to 180 degree angles between the driver and the driven shafts.

We use mounts to mount a DC motor with shaft coupled to it. We then use six rods to link driver shaft with the driven shaft. We use accurate drilling with relatively spaced and diametered holes to attach the connection rods with precision. We then use mounts to hold the driven rod in precise position. Now the motor can be powered using 12V supply and can be used to drive the other shaft using elbow mechanism.

Advantages

- No Gears Needed
- Easy placement in restricted spaces



DIFFERENTIAL

This model simulates the mechanism of a differential gear used in cars and other wheeled vehicles. It is a gear train with three shafts that has the property that the rotational speed of one shaft is the average of the speeds of the others, or a fixed multiple of that average.

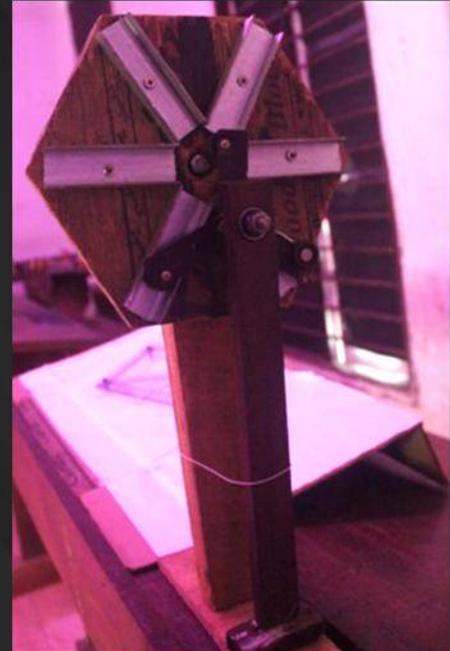
A differential allows the outer drive wheel to rotate faster than the inner drive wheel during a turn. This is necessary when a vehicle turns in order to allow the wheel that is traveling along the outside of the turning curve to roll faster and to cover greater distance than the wheel on the inside of the turning curve.



PERPETUAL MOTION MACHINE

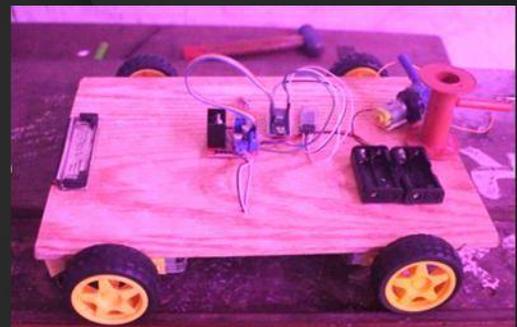
Perpetual motion refers to a movement that goes on forever once started without additional energy added. A machine that could be set in motion once would continue to move forever. Such a device or system would be against the law of conservation of energy. This law states that energy cannot be created, or destroyed, but one form of energy can be transformed into a different one. Perpetual motion machines have interested inventors for a long time, and even though it has been shown that such a machine cannot exist, people still try to build them.

The first law of thermodynamics is the law of conservation of energy. It states that energy is always conserved. It means that energy can be neither created nor destroyed. Instead, it simply changes from one form to another. To keep a machine moving, the energy applied should stay with the machine without any losses. Because of this fact alone, it is impossible to build perpetual motion machines.



BLUETOOTH CONTROLLED FIRE ESTINGUSHING CAR

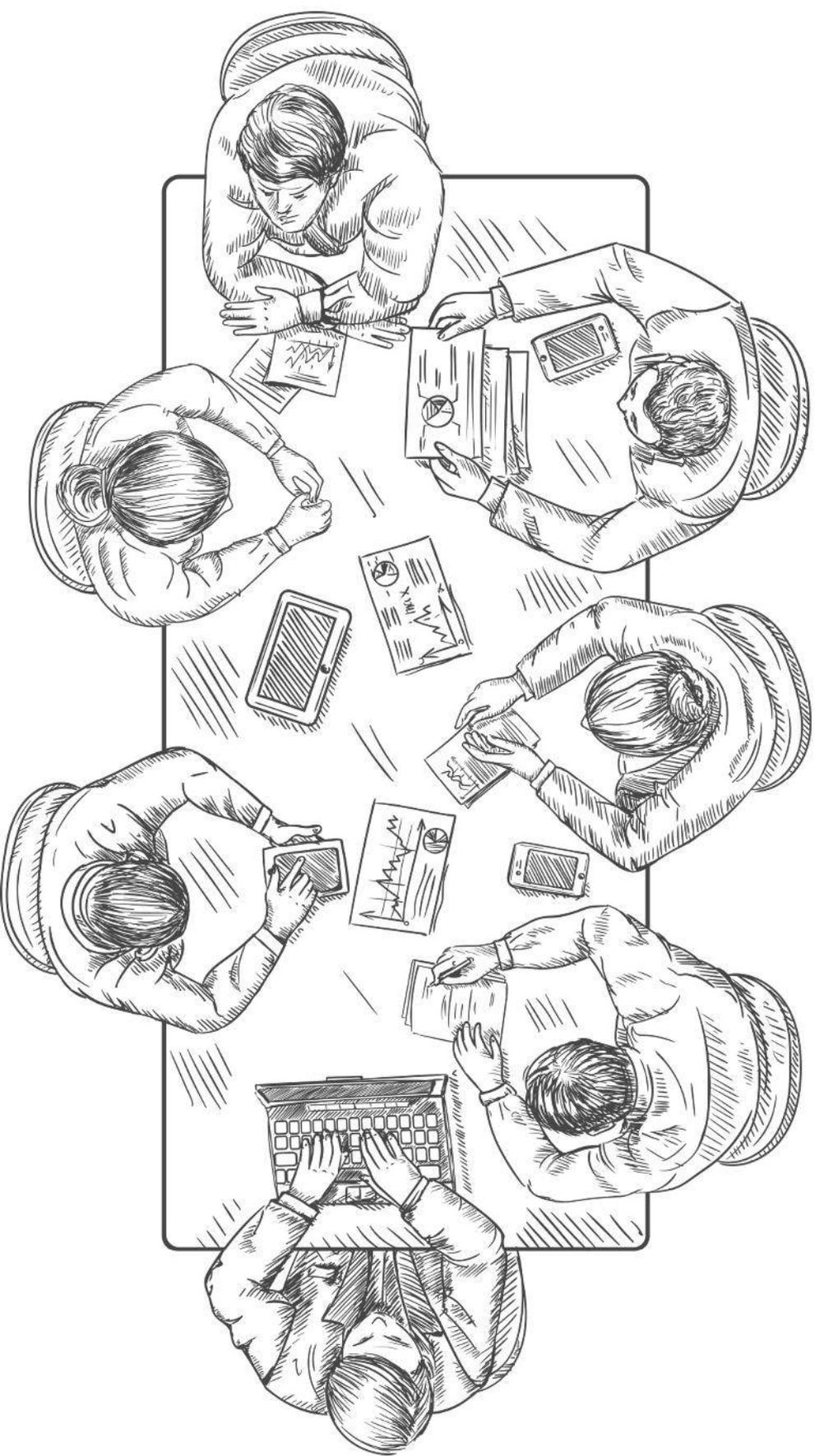
This is a car that can be controlled using a mobile app that works with bluetooth and extinguish fire by sensing fire using sensor. It helps human beings to stay away from a fire affected area and control it from far location to extinguish fire. It will reduce human efforts for such cases. It is fully programmed in adruino which controls the whole system.



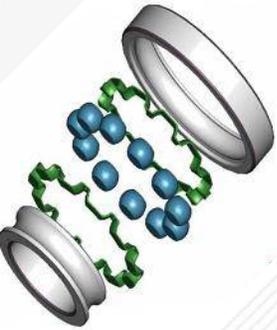
INFINITY CUBE

Infinity cube can be made using old bike chais or cycle chains. A welder is required to join the chains of unequal lengths. We were not able to point out the actual starting and ending of this structure. Infinity cube aimed to improve our focus, allowing us to concentrate on the task at hand. You can have it as a wonderful decoration





PROJECT REPORTS



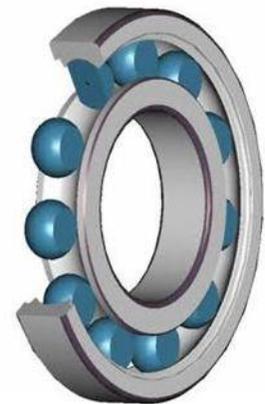
VIBRATION ANALYSIS AND FAULT DETECTION OF BALL BEARINGS IN INDUSTRIAL MACHINERIES

The vibration signal analysis is done using different methods such as power spectrum analysis, order analysis, cepstrum analysis and envelope analysis.

Machines are damaged by different factors such as wear and tear, dirt, improper lubrication, operational mistake or manufacturing error. These damages are potential causes of failure and a failure can lead to downtime of the machinery. To avoid financial implications of a downtime, the most advanced maintenance approach used is a predictive approach. This approach uses continuous condition monitoring for analyzing the health condition of the machine.

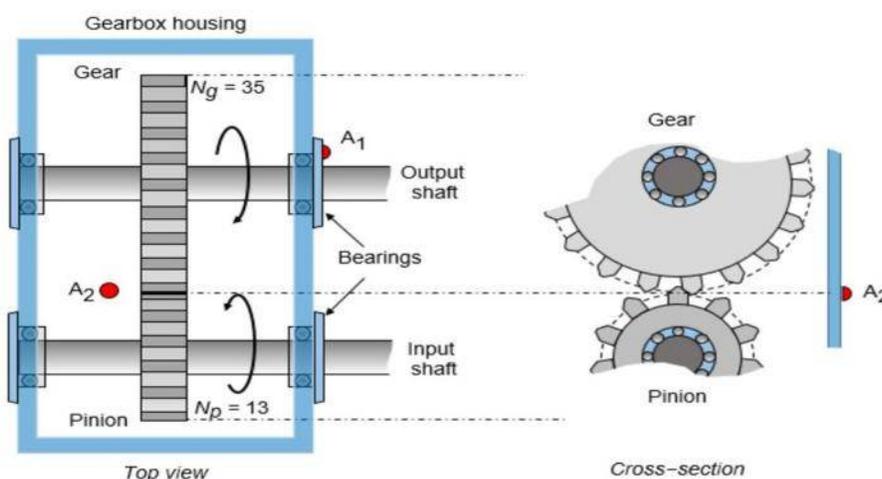
The students of the mechanical production engineering department project, Anandhu Anil Bipin Ravindran, Harshith Kumar K, Mathias Binson, guided by Prof. Shifin A S, are working on a project aimed at fault diagnosis in ball bearings using condition monitoring, because a bearing is always a critical component in a machine.

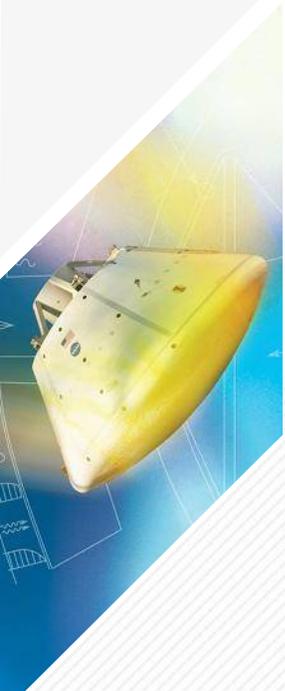
A bearing consists of different types of defects which may arise due to various operations. A detailed literature study is aimed about these defects and its theoretical parts are analyzed. The diagnosis uses the vibration signal and the signal processing is done using vibration analyzer.



The project mainly focuses on power spectrum analysis for finding out the defects. An attempt is also done to analyze the severity of the defect using vibration levels produced.

Prof Shifin A S
Anandhu Anil
Bipin Ravindran
Harshith Kumar K
Mathias Binson

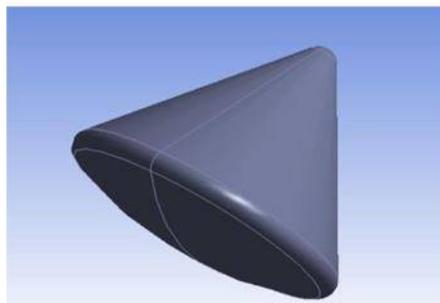




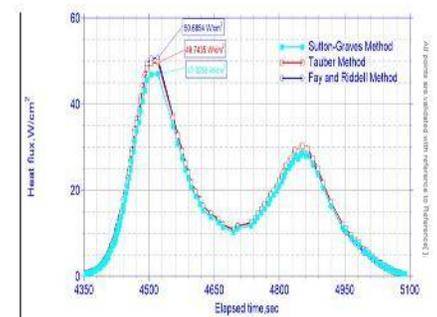
Sample return capsules, as the Apollo Command Module have been widely used to advance the knowledge and planning of manned lunar and planetary return missions. Such reentry vehicles undergo extreme thermal conditions, caused by shock-heated air during their super-orbital atmospheric re-entry. Such extreme conditions can result in failure of the aeroshell structure and loss of important payload. This technological challenge is addressed by the use of ablative thermal protection systems (TPS), which dissipate the heat away from the vehicle's front wall via ablative products released into the boundary layer. Additionally, such velocity and temperature magnitudes during reentry conditions introduce significant radiative heat loads, filling the shock layer with radiators that react with the ablative species injected by the capsule wall.

NUMERICAL ESTIMATION OF HEAT FLUX AND DETERMINATION OF OPTIMUM THICKNESS FOR ABLATIVE THERMAL PROTECTION SYSTEM OF RE- ENTRY VEHICLES

Therefore, accurate numerical modelling techniques are required, so that the thermophysical, thermo-chemical environment of a reentry capsule can be successfully reproduced and predicted. The students of the mechanical engineering department, Athul T P, Nithin S, Sarath Nadh M, Vishnu Sasindran, guided by Prof. Faraz P Junaid aims to numerically rebuild certain significant trajectory points, containing the peak heating points of the Apollo terrestrial reentry. This requires the coupling of the resolved flow-field with radiative and ablative effects in order to accurately predict the convective and radiative heat flux for each trajectory point. The results will be compared to previous calculations and existing flight data.



Thermal analysis model



Heat flux estimation results for the stagnation region of command module

Thermal analysis methods for re-entry vehicle structure are presented. At first CFD/FEM coupling thermal analysis for the experimental vehicle were introduced. Then the finite element modelling problem is treated. This project work aims to describe an optimization procedure for the design of ablative heat shields, thereby resulting in an optimum thickness for the heat shield of Apollo command module.

Prof. Faraz P Junaid
Athul T P
Nithin S
Sarath Nadh M
Vishnu Sasindran



Driven by the rise of electric vehicles and stationary storage applications, large battery systems emerge from a niche to a standard product with serious production volume. However, some technological challenges in handling those batteries still remain. Especially in those new complex and high-performance applications, there is a significant need for battery thermal management, heating and cooling. Hence, depending on ambient conditions, a considerable amount of the effective battery energy has to be deployed for tempering the system.



BATTERY THERMAL MANAGEMENT SYSTEM USING PHASE CHANGE MATERIALS

Up to now mainly active components have been used for this task, that not only reduce the overall efficiency, but also increase system weight, volume and maintenance effort.

Electric vehicles undergoing fast charging and discharging cycles will raise the temperature of the battery system. The temperature rise should be contained within the limit so that it doesn't favour undesirable chemical reactions in the system such as corrosion. The students of the mechanical engineering department, Arun Chandran, John P George, Joel Prekash and Jovial Alex Lejo, guided by Dr. Rijo Jacob Thomas, have developed an experimental set up of the battery thermal management system which consists of Phase change material (PCM) based cooling and liquid cooling.

The phase change materials absorb the latent heat of fusion for the phase transition from solid to liquid at a constant temperature. The PCM is uniformly distributed between the battery layout. This uniform distribution helps in the uniform distribution of temperature. Also Liquid cooling is provided in a channel.

The channel helps in bringing down the temperature of the system. With the introduction of liquid cooling, the uniform temperature distribution is disrupted. Temperature distribution can be made uniform by increasing the number of channels between the modules. A three dimensional cylindrical battery model was designed and effects of various parameters like mass flow rate and melting point temperature of PCM on the properties of the system were studied. The properties that are studied are maximum temperature of the system, temperature difference within the system. The maximum temperature should be limited within an optimum range that is best suited for the maximum life of Lithium-ion batteries.

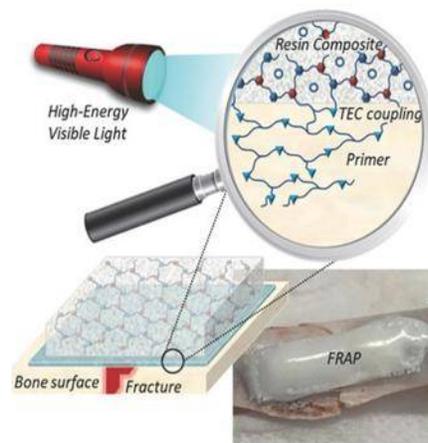
Dr. Rijo Jacob Thomas
Arun Chandran
John P George
Joel Prekash
Jovial Alex Lejo

BONE FRACTURE FIXATION USING ADHESIVE COMPOSITE

multiple layers: an acidic self-etching primer is laid directly on the bone's surface to expose the collagen fibers of the bone, and to enable entanglement of the surface with the adhesive. A layer of fiber is placed on the area to be treated and then another layer of adhesive is placed on top. Cyanoacrylates are the most commonly used group of adhesives for bone fixation. They have been found to have good biomechanical strength and also work in a wet environment. Through this project we aim at using a FRAP made of prime & bond which is a commonly used dental adhesive and polypropylene mesh (hernia mesh) which is commonly used in hernia surgeries to fix a fractured bone.

A fractured bone must be carefully stabilized and supported until it is strong enough to handle the body's weight and movement. The process of fixing a bone fracture has always been a tedious process, even with the rapidly advancing biomedical industry. The use of rigid fixation devices, miniplates and microplates, has transformed the treatment of maxillofacial bone fractures. With these conventional techniques, for a major bone fracture to be fixed, it takes more than one surgery and expensive metal implants. Their use is troublesome when fixing fine bone or whenever there is a risk of the perforations made by fixing screws or pins damaging important soft tissue. Perfect adaptation of bone fragments often takes up a lot of time and may be particularly difficult in some areas, where metal implants are difficult to be placed. Fracture fixation using adhesive is a promising alternative in craniofacial surgeries.

Biocompatible dental adhesive composites can be used for this purpose. The students of the mechanical production engineering department, Jithinkumar N, Jestin Joy, Sherin Shaji, Ayana Antony, guided by Prof. Anand Sekhar have done a project using biocompatible dental adhesive composites that resulted in a composite fixation that is obtained by adhesive resin layers having fiber meshes in between them, and the layers are photocured by UV light.



The advantages include the ease of application and avoidance of drilling holes that may weaken the bone and cause fractures. Due to the similarity between bone and dentine, dental adhesives will be very effective in joining bone fragments even in the soft and fine areas. The patch consists of

Prof. Anand Sekhar
Jithinkumar N
Jestin Joy
Sherin Shaji
Ayana Antony

COMPOSITE PARABOLIC TROUGH SOLAR COLLECTOR FOR LOW AND MEDIUM TEMPERATURE APPLICATIONS

In response to increasing concerns over the shortage of fossil fuel resources and environmental degradation due to fossil fuels, alternative renewable energy sources have been developed as an economic and environment friendly alternative. Solar energy due to its abundance and more even distribution in nature than other types of renewable energy sources can be explored most, especially in India.

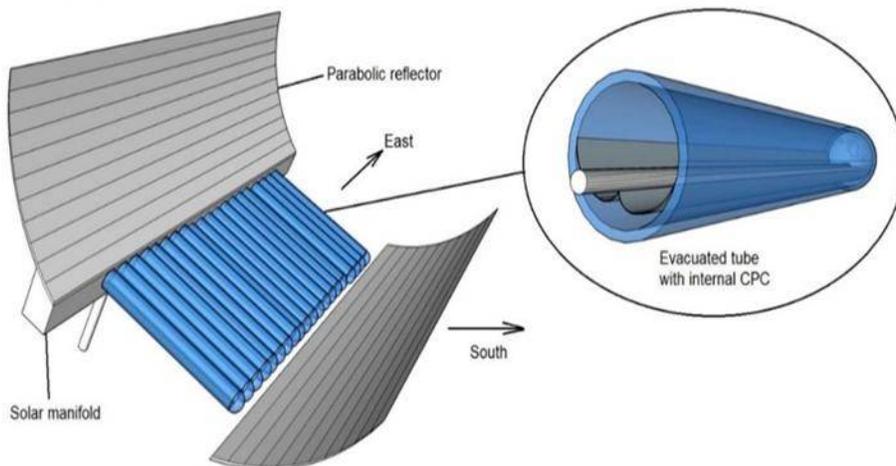
Concentrating solar power (CSP) technologies are one of renewable technologies that are able to solve the current and future energy problems. Solar Energy due to its uniform distribution and abundance than other renewable energy sources is the best alternative.

Parabolic trough solar thermal collectors can supply thermal energy over a wide range of temperatures and presently are a preferred solar technology for low and intermediate temperature applications.

The students of the mechanical production engineering department, Arun das M, Bharat R Nair, Neil Sixtus, Karthik R S guided by

Dr. Baiju V, have devised a project conceived with the aim to fabricate a light, rigid, low cost composite parabolic trough solar thermal concentrator for low and medium temperature applications. A lightweight and rigid supporting structure is to be fabricated with a solar tracking mechanism to capture maximum solar radiation. Then an experimental evaluation is to be carried out on the developed system with and without solar tracking at different flow rates of different heat transfer fluid. In particular, it can be used in solar cooling, soil disinfection, laundry, food processing and other domestic hot water applications, in which working the temperature of the system is lower than that of the hot water supply.

Dr. Baiju V
Arun das M
Bharat R Nair
Neil Sixtus,
Karthik R S





DERELICT LEO SATELLITE DEORBITAL SOLUTION USING AIR BREATHING SATELLITE ATTACHED TO A COMPRESSED GAS

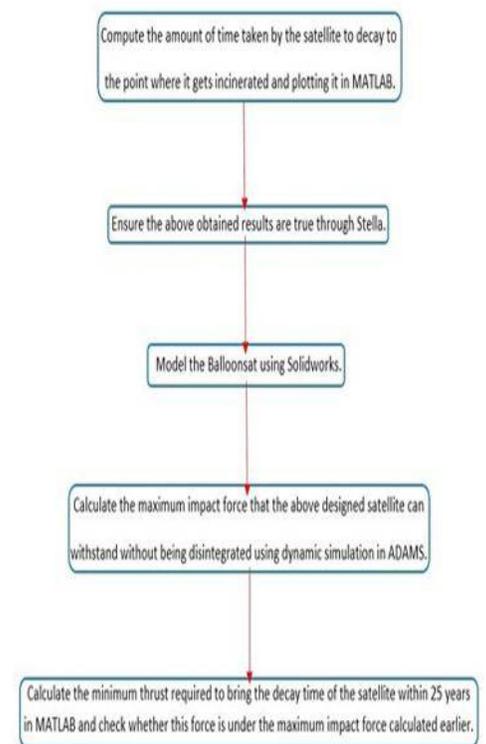
Growing space debris has been aggravating the complications of space exploration missions in recent years. The debris population has been increasing exponentially since the seventies. Here we are studying the possibilities of a new concept for deorbiting Lower Earth Orbit derelict satellites, which has the capability to deorbit a number of satellites in its lifetime, and is cost effective.

The students of the mechanical engineering department, Akshay R M, Goutham B Raj, Amal K, Jithu George, guided by Prof. Syed Mohammed Fahd, have proposed



concepts that consist of launching an air breathing satellite attached to a compressed gas system. The air taken in to the satellite is passed through the diffuser and the compressed air thus created is used to inflate a balloon made of mylar. Both the diffuser and balloon are connected through a structure having a number of nozzles on its outer surface. This proposed concept can be called the VenatorSat.

The variable size of the balloon is used to vary the aerodynamic drag of the test satellite such that it shows the Lower Earth Orbiting passive satellites causing it to deorbit and incinerate in the earth's inner atmosphere. The size of the Venatorsat is varied by drawing out the air from the balloon through a nozzle and the reaction force thus generated can be used to park the Venatorsat in another orbit closest to the next debris to be deorbited. An electronic controller is used to regulate the gas departing from the nozzle on the basis of Travelling Salesman Algorithm in order to optimize the Hohmann orbital transfer sequence.



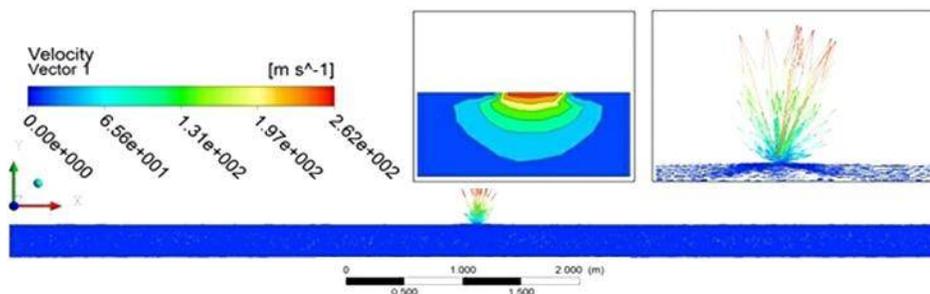
Prof. Syed Mohammed Fahd
Akshay R M
Goutham B Raj
Amal K
Jithu George

PIPELINE LEAKAGE AND PREDICTION SYSTEM

Water is one of the most important and life sustaining elements of our ecosystem. Public and the governments have disregarded water leakage issues in the past. They've put lesser efforts into solving water leakage problems because they are of the impression that the water tariff is very cheap, so the monetary amount attributed by water leakage is inconsiderable. To them water resources seem to be abundant and unlimited. This scenario has rapidly changed over the past few decades. In fact, the next world war could be fought over water.

Thus the development of an efficient and cheap water leakage detection system is of utmost importance for a developing country like India. Such a system can greatly cut down the costs incurred by Government organizations, money that can be spent on other social programmes. This is where the relevance of our project comes into picture. We are developing a system that not only can be used by public and private water firms, but also would be of great help to farmers who face such a snag. This system will be cost efficient to ensure that all will be able to implement it. The students of the mechanical engineering department, Akshay Reji, Akshay Ravi, Amos Emmanuel, and Mohammed Ansar, guided by Prof. Shifin A.S have come up with a brilliant project to help curb this problem of pipeline leakages in a cost efficient way.

The "Pipeline Leakage and Prediction System" will be able to pinpoint the exact location of the pipeline leakage. This is made possible by a series of sensors incorporated along the pipeline at a fixed interval. The distance at which the sensors have to be placed is determined mathematically. The range of the sensor was fixed after thorough analysis in ANSYS FLUENT by evaluating various key components such as whether the flow was Laminar/Turbulent, Pressure Fluctuations and Velocity Distribution. One other key feature of the system is that it is able to optimize the identification of potential leakage location before the crack materializes and propagates. This is made possible by compiling and analyzing the pre-collected data by incorporating Machine Learning. All the initial design and further remodeling were done with the help of SolidWorks.



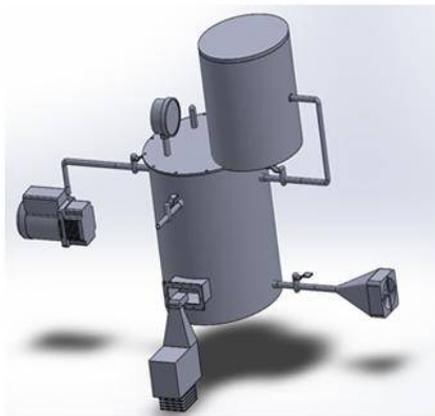
Prof. Shifin A.S
Akshay Reji
Akshay Ravi
Amos Emmanuel
Mohammed Ansar

SOLAR POWERED WATER GENERATION SYSTEM USING ADSORPTION

The ever-growing population of the world, coupled with a decline of the ground water table and fluctuating rainfall pattern, necessitated the existence of a solution to the grave problem of water scarcity. It is highly prevalent in the northern dry states of India and shows potential of existing even in the rainfall-concentrated southern states of India. Due to the temperature rise, the amount of water evaporated from open water resources has caused the humidity level to rise up. This humidity level, which signifies the untapped potential of water reserves in the atmosphere, pointed to the idea of a device that can efficiently harness the available water vapour content. Thus, the atmospheric water generator was conceived.

However, traditional methods of using a compression or absorption system have high global warming potential and greenhouse potential.

This drawback along with power consumption of these systems (which further adds to the greenhouse potential) paved the way to the students of the mechanical engineering department, Jose Gijo, Amal P Raj, Hari Babuprakash, Abin Varkey and Ananthu V Pillai, guided by Dr. Baiju V to design and make an atmospheric water generator—which uses an adsorption system coupled to a solar panel.



A desiccant plate is used to adsorb moisture from the air supplied. The adsorbed moisture is then released by microwave irradiation and condensed to produce clean drinking water. The solar panels supply clean energy for meeting a part of the energy requirements of the system. The

desiccant used in the system for general design is silica gel, which is low cost, easily available and has high affinity towards water vapour, thus eliminating any further need for purification. Compared to earlier renditions that make use of vapour compression systems, the efficiency of the system is comparably high due to its less energy exhaustive water vapour capture and subsequent desorption of water molecules from its surface. Thus, every process associated with the atmospheric water generator proves the economic and social importance of the proposed system..

Dr. Baiju V
Jose Gijo
Amal P Raj
Hari Babuprakash
Abin Varkey and
Ananthu V Pillai



WASTEWATER TREATMENT PLANT



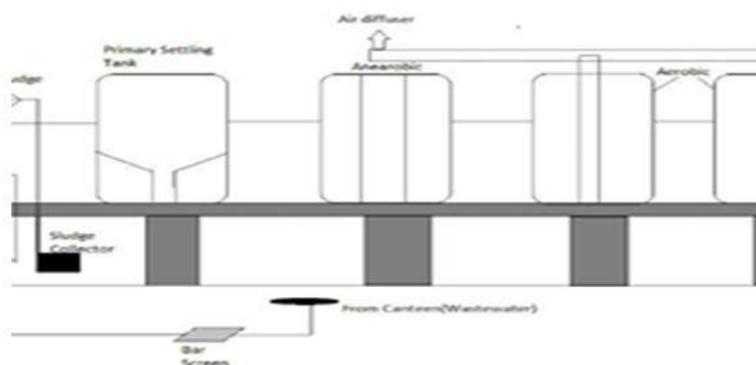
Every household produces similar kinds of wastes. The composition of wastewater in every household is almost similar. The quantity of waste water generated is directly proportional to the amount of water consumed by the household. Kitchen wastes contribute to the major share of wastewater which contains a considerable amount of organic wastes. In case of a small scale hotel or canteen, the kitchen waste accounts for the majority of waste water generated. Therefore there is a requirement to treat the

organic and inorganic wastes produced in the kitchen.

The college canteen of T K M College of Engineering doesn't have an existing system to treat the wastewater generated. Currently the waste water is not treated or reused. Solid wastes are manually segregated into organic and inorganic wastes. The organic waste is supplied to cattle farms and inorganic wastes are buried or burned. This is why the students of the mechanical engineering department, Akhil Sajeew, Hormis S Parangimalil, Joel John and KJ Ananthkrishnan, guided by Prof. Ahammad Vazim have taken a step ahead by aiming to install a treatment plant within the college campus to handle the complete wastes produced by the canteen which includes wastewater and the solid wastes.

Each situation is unique in case of size of the plant required, quantity

of the water to be handled, the constraints in space utilisation etc. Component size also varies according to the requirement. Components like bar screen, carbon filter etc. can be constructed by ourselves, adding it to the cost reduction. Whereas components like blower, motor etc. have to be purchased. By analysing the situation at the college canteen, a system has been formulated, area is identified, and quantity has been fixed. The project will be able to meet the required quantity demand with minimum space utilisation at a minimum cost.



Prof. Ahammad Vazim
Akhil Sajeew
Hormis S Parangimalil
Joel John
KJ Ananthkrishnan



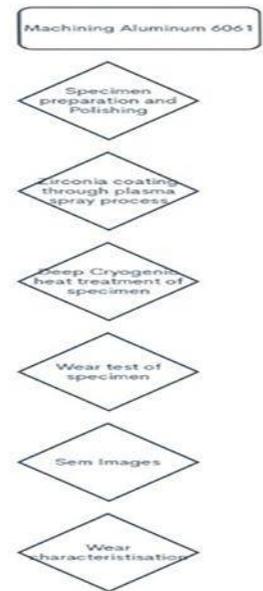
STUDY ON THE EFFECT OF DEEP CRYOGENIC HEAT TREATMENT ON ZIRCONIA COATED Al 6061

Aluminium has been one of the widely used materials for manufacturing purposes. The properties of aluminium like low density and resistant to corrosion make them one of the widely used metals. But due to its high reactivity it exists in the form of oxides mostly. Since aluminium at its original form lacks strength or property for performing any machining process, it is always alloyed. Aluminium is alloyed to improve its mechanical properties by using alloying agents like copper, zinc, magnesium etc. One such widely used aluminium alloy is Al-6061 T6, It found application in construction of

aircrafts, chassis of automobile, aluminium cans for packaging etc. It also has a good weldability.

But being used in manufacturing of components the Al 6061 T6 alloy undergoes wear at considerably low load application. So in order to reduce the wear of the component the Al 6061 Alloy, the students of mechanical engineering, Ashwin R S, Asif Al Irfan, Faheem Badarudeen and G K Abhinand, guided by Prof. Rakesh Pillai has devised a method by giving a ceramic coating of zirconium using plasma spray method.

The coated material is then given a low temperature treatment using liquid nitrogen. The specimen is given a controlled dipping at various intervals varying from 20 minutes, 40 minutes and so on. The low temperature treatment would bring about an alteration in the microstructure of the specimen by increasing its hardness.

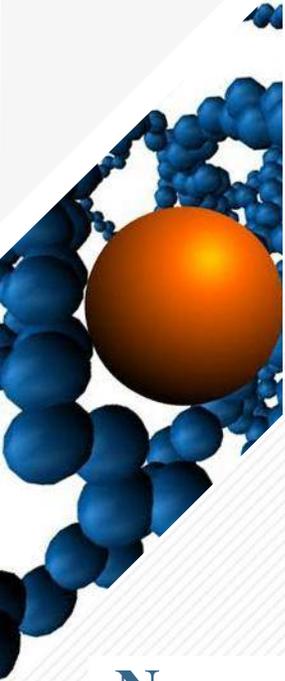


The dipping process is carried out in a controlled form so that there occurs no sudden temperature change avoiding much deviation from the required structure. The treated specimens are loaded on to a pin on disc arrangement in a preloaded condition one by one and it is rubbed against a standard disc thus analyzing whether the specimens have achieved any improvement. The specimens are prepared in batches to achieve a good result.

Prof. Rakesh Pillai
Ashwin R S
Asif Al Irfan
Faheem Badarudeen
G K Abhinand

Table
Plasma spray parameters.

Materials	Primary gas (argon) pressure (kPa)	Secondary gas (H ₂) pressure (kPa)	Carrier gas (argon) flow (lpm)	Current (A)	Voltage (V)	Spray distance (mm)	Feed rate (kg/h)
TC1	700	520	60	600	65	64-125	2.7
TC2	345	345	37	500	75	50-100	5.4
BC1	520	340	37	500	70	100-150	3.2
BC2	700	340	37	500	65	100-175	4.1



Nanocomposites are class of material which exhibits better thermal, mechanical properties thus found to have wide range applications. They are now reducing the usage of metals in automotive parts so as to reduce fuel consumption, better strength to weight ratio etc. Carbon Nanotubes (CNT) based nanocomposites is catching attention among automobile manufacturers. CNT has high strength to weight ratio thus used as main material in automobile bodies.

Many dedicated researches are currently undergoing in this field so as to develop nanocomposites that perform better than metals like aluminium and steel which are majorly used in automobiles. Nanocomposites made up of coconut shell nanoparticles and epoxy matrix were used for car bumpers. This nanocomposite is found to have good hardness and impact strength. This was tested in Carina model car of Toyota where its

NANOCOMPOSITES FOR AUTOMOTIVE APPLICATIONS

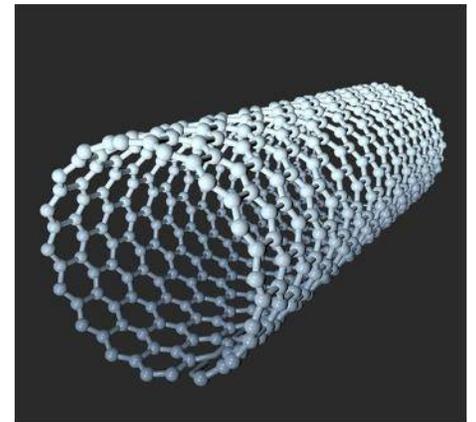
impact strength has found to be increased by 37.5% than normal bumper material.



Car bumper prototype made up of coconut shell nanoparticle reinforced epoxy nanocomposite

Tyre is important part of automobile. The major constraints in designing the automobile tyre is wear, heat-build-up, tensile-strength. These all depended upon material properties. Reinforcing Styrene Butadiene Rubber with clay nanoparticles (Cloisite 15A) and carbon black was used for designing tyre tread. This nanocomposite based tyre provides good wear resistance, less heat build-up which thus reduces the expansion of tyres under hot condition thus improving its dimensional stability and also good tensile strength. Another nanocomposites used for making tyre was rubber/butadiene blend polymer reinforced with Carbon Nanotubes (CNT) and carbon black. This material provides better thermal conductivity, good abrasion resistance and better tensile strength which is an ideal requirement for tyres. The properties of this nanocomposite was

enhanced at 5 PHR(Parts per Hundred Rubber) of CNT addition.



Carbon Nanotubes

Nanocomposites based brakes pads are also used and they were found to be perform better than normal brakes pads made up of metals or ceramic. Epoxy reinforced with Multi-Walled -CNT (MWCNT) along with short carbon fibres and graphite was used as material for brake pads. These nanocomposite based brake pads were found to have better properties like low wear rate, good tribological and mechanical properties due to presence of MWCNT.

Nanocomposites are extending its usage in development of engine parts. Aluminium matrix reinforced with carbon nanotubes were used in development of piston, engine block etc. The compressive strength of the nanocomposites is attained near to the value of 800 MPa and hardness is attained

around 168 BHN. The thermal conductivity of material is also enhanced due to presence of Carbon nanotubes, which is an important property required for engine parts. Nano diamonds based nanocomposites are also used for development of engine parts. The properties of nano diamonds like its hardness, thermal conductivity and good mechanical properties are correlating with property requirement for engine parts. Aluminium matrix reinforced by nano diamonds is one such example. Small addition of nano diamonds improved the properties of nanocomposites to a higher extend. CNT and nano diamonds based nanocomposites materials were able to provide high strength to weight ratio which reduces the fuel consumption.

Coatings are used in automobiles for resistance against corrosion, shielding against UV rays etc. Rubber modified Polybenzoxine/-SiO₂ nanocomposites were used as corrosion resistant coatings. They are superhydrophobic in nature which is found to be an important property for being corrosion resistant. The presence of silica content provides superhydrophobic properties. Nanocomposites based coatings for shielding of UV rays were also developed. It was found to be more efficient in absorbing harmful UV rays which cannot be done normal shielings. Silicone matrix reinforced by zinc nanoparticles is used as nanocomposite coatings for windows of

automobiles. This nanocomposite is found be more efficient in absorption of UVB rays which is harmful to human life. Absorption of UV-B rays depends upon the size of zinc nanoparticles. Smaller size zinc nanoparticles help in better absorption of UV-B rays

Nowadays researchers are introducing the concept of green, that is to reduce pollution by using eco-friendly materials. This concept is well applied in nanocomposites. Researches are going on to nanomaterials derived from nature to make nanocomposites, such one is called green nanocomposites. Even tough nanoparticles impart good properties higher than macroscopic materials, but they are costlier. Development of low-cost green nanocomposites would help in overcoming this challenge. The properties of green nanocomposites are low cost, low carbon emissions, less toxic, recyclability. The commonly used nanomaterials for green nanocomposites is nanocellulose. Green nanocomposites are used for interior parts of automobiles. Cellulose nanofibrils embedded in polyethylene matrix is used for manufacturing carpets which had even replaced rubber mats which was earlier used in automobiles. As rubber is nonbiodegradable which would posses a great environment in its future uses. These nanocomposites were found to have better impact and flexural strength.



Hydrophobic Coatings



Zinc-Nanoparticles

From above findings, what we can understand is how much importance nanocomposites had in automobiles. It would be wondering that small percentage of nanoparticles addition had resulted in good mechanical properties, with high strength to weight ratio. It outstands among all materials used in automobile due to exceptional properties. Also more research is now focussing on areas of usage of nanocellulose to develop nanocomposites for major parts of automobiles where mechanical properties are an important. Nanocomposites can be called as 'future of automobile industry'.

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