CASE STUDY

RULES AND REGULATIONS

PROBLEM STATEMENT

- *Teams that qualify from the first round will be eligible for the second round*

Choose one among the below mentioned Topics and come up with creative solutions.

Round : 1

Problem statements :

- ***Thermal management of Li-ion EV batteries:*** *This case study requires you to propose an optimised technique for thermal management of Li-ion EV battery packs. The effect of charging & discharging rate, topology of battery pack, fluid flow rate on temperature of Li-ion EV battery is required to be investigated. The candidates are supposed to choose a specific cooling technique (Ex: Air cooling, indirect liquid cooling, direct liquid cooling, etc.). For the selected cooling technique, the above investigation is needed to be performed with respect to Indian weather conditions.*
- **Design Thinking for Product Innovation:** This case study challenges participants to apply design thinking principles for product innovation in the mechanical engineering sector. Choose a specific product category within the mechanical engineering domain (e.g., consumer electronics, automotive components, or industrial machinery) and propose a design thinking approach for its innovation. Investigate user needs, market trends, and technological advancements to inform the design process. Explore

how cross-functional collaboration, prototyping, and user feedback can be integrated into the product development lifecycle. Assess the potential impact on market competitiveness, user satisfaction, and business growth. Additionally, analyse the feasibility of implementing sustainable design practices within the innovation process.

- ***Additive Manufacturing Optimization :*** This case study involves the optimization of additive manufacturing processes, specifically focusing on 3D printing of metal components. Participants are required to investigate the influence of key parameters such as layer thickness, printing speed, and build orientation on the mechanical properties and production efficiency. Choose a specific metal alloy commonly used in additive manufacturing (e.g., titanium or aluminium) and justify your selection. The investigation should consider the trade-offs between speed, material usage, and part quality. Additionally, propose strategies for minimising post-processing requirements.
- **Machine Learning for Emission Reduction in IC Engines:** This case study centres around the application of machine learning and artificial intelligence to reduce emissions in internal combustion engines. Participants are tasked with proposing and implementing machine learning algorithms that optimise engine performance while minimising pollutant emissions. Consider factors such as fuel injection timing, combustion chamber design, and exhaust gas recirculation. Investigate how real-time data from sensors can be used to train and adapt the machine learning models. Assess the potential impact on emission reduction, fuel efficiency, and overall engine performance. Additionally, discuss

the challenges and opportunities associated with integrating machine learning into traditional engine control systems.

Round : 2
Problem statements :

- ***Data centre cooling:*** *This case study involves a detailed investigation of next generation data centre cooling strategies (Ex: Air cooling, liquid cooling, and others). The detailed statistical analysis of cooling power consumption w.r.t IT power and electrical power in various cooling strategies used in the present era is to be investigated. Now, based on the above investigation an ideal cooling strategy needs to be decided and justified. For the chosen cooling strategy the effect of server level heat load, flow rate on total power consumption is to be investigated.*
- **Smart Manufacturing Implementation:** In this case study, participants are tasked with proposing a strategy for implementing smart manufacturing techniques in a traditional manufacturing facility. Explore the integration of Internet of Things (IoT) devices, machine learning algorithms, and real-time monitoring systems to enhance production efficiency and quality control. Investigate the potential challenges and benefits associated with the transition to smart manufacturing. The chosen manufacturing process (e.g., CNC machining or injection moulding) should be justified in the context of the industry. Provide insights into how the proposed smart manufacturing solutions can adapt to various production scenarios and contribute to long-term sustainability.
- **Product Lifecycle Management (PLM) Integration:** In this case study, participants are challenged to integrate Product

Lifecycle Management (PLM) principles into the business operations of a mechanical engineering company. Explore how PLM can streamline product development, from concept to end-of-life, and enhance collaboration among cross-functional teams. Analyse the potential impact on time-to-market, product quality, and cost efficiency. Additionally, participants should investigate the integration of PLM software with other business systems (e.g. ERP) to optimise overall operational efficiency. Assess the long-term benefits and potential challenges associated with adopting PLM and recommend a phased implementation approach.

- **Sustainable Fuel Integration in IC Engines - Combustion Optimization:** This case study revolves around the integration of sustainable fuels into internal combustion engines with a specific focus on combustion optimization. Participants are required to explore the performance of IC engines using alternative fuels (e.g., biofuels, hydrogen, or synthetic fuels) and propose strategies for optimising combustion efficiency, power output, and emission levels. Investigate the impact of different fuel properties on ignition timing, flame stability, and combustion duration. Consider modifications to engine components or systems that could enhance compatibility with sustainable fuels. Evaluate the economic and environmental implications of transitioning to these alternative fuels and discuss potential challenges and solutions in the combustion optimization process.

RULES :

- *Each team consists of 3 participants*
- *The contestants will be given a total of 8 minutes for presenting their work.*
- *The presentation should be your own work. Elseways leads to disqualification*
- *A copy of the presentation (Not Abstract) should be sent to mechanica.events@gmail.com a day before the event. Please make sure you add your details in this mail*
- *Number of slides per presentation should not exceed 15*
- *In case of any issues the decision of the judges will be final*
- *Any details about event are subject to change based on situation*

FAQ

- *How to register for the event?*

Registration link is on the website. On spot registrations is also available

- *Do I need to bring a copy?*

We insist you to bring a copy of your work in easily accessible format(pen drive etc....)

- *Do we need to pay for the event?*

MEA members need not pay anything for this event.
For non-MEA members from inside and outside IITM, they need to purchase the Mechanica Passport just for Rs 350/-. Participants can attend lectures and participate in a range of exciting events and competitions, including paper presentations, case studies, idea challenges, and quizzes with a prize pool of more than 1 Lakh. Additionally, a hard copy certificate will be provided to participants who attend all the events they sign up for.

For further details contact

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