EG5016B – Exploring Engineering Project Management

BEng/MEng Mechanical Engineering
BEng/MEng Mechanical Engineering (Automotive)
BEng/MEng Electrical and Electronics Engineering

INDUSTRY LIVE BRIEF

Thank you for supporting our undergraduate students with a Live Brief. This form will help us capture the key information for your proposed challenge and ensure a rewarding experience for the students involved.

1. Organisation / Contact Details

- **Organisation name** : Red Bull Powertrains 2026
- **Your name** : Giovanni Colangelo
- **Job Title / Role** : Senior Mechanical Performance Development Engineer
- **Email Address** : Giovanni.colangelo@redbullpowertrains.com
- **LinkedIn Profile (optional)** : www.linkedin.com/in/giovanni-colangelo-a37520121

2. Title of the Challenge

A short, clear title (e.g. "Redesigning a Modular Bike for Urban Use")

Conceptual valvetrain optimisation for a High-Performance Engine

3. Summary of the Brief

A short description (250 – 300 words) of the real-world engineering problem you would like the students to work on.

The valvetrain is one of the most critical subsystems in a racing engine, governing airflow, combustion efficiency and overall performance. In a Formula 1 V6 engine, camshafts, followers, valve springs and actuation geometry must operate reliably at extremely high engine speeds, with minimal friction and mass, while maintaining precise timing control. Even small changes in valvetrain design can significantly influence engine efficiency, durability and performance.

This project challenges students to explore conceptual optimisation of a valvetrain system for a high-performance engine. The combustion chamber design is assumed to be fixed; the focus is on how valve actuation strategies and design variables can be optimised to improve airflow, reduce frictional losses, and maintain reliability at high rpm. Students will compare different valvetrain approaches (e.g. rocker-arm vs direct-acting, pneumatic vs spring return, lightweight vs conventional materials) and evaluate their trade-offs.

The outcome will be a conceptual design study, supported by CAD layouts, analysis and a Design for Excellence assessment. Students will present their optimisation approach, highlighting how performance, manufacturability, cost, sustainability and durability trade-offs shape the final design.

4. Background or Motivation

What is the industry context or reason behind this challenge?

In F1 and other high-performance industries, valvetrain development is a key area of innovation. Traditional mechanical systems are limited by inertia, wear and spring behaviour, while modern designs push the boundaries with lightweight materials, pneumatic actuation and advanced timing strategies. Outside motorsport, similar principles apply in road-car engines, motorcycles and even industrial machinery. This challenge mirrors real-world engineering: how do you design a valvetrain that delivers high performance and durability under extreme conditions, while balancing manufacturability and cost?

5. Constraints/Special Considerations

Any key requirements such as sustainability, manufacturing, cost, regulations, or customer needs?

Performance: Must be capable of operating conceptually at engine speeds up to ~15,000 rpm.

Scope: students focus only on valve actuation and timing architecture.

Cost: Materials and manufacturing choices must be justifiable for prototype or small-series production.

Manufacturing: Consider realistic production methods (machining, casting, additive for lightweight parts).

Educational Value: Students must demonstrate trade-offs between mass, stiffness, actuation method, friction, and reliability.

6. Presentation and Acknowledgement

Do you consent for the student work on this brief to be presented at our Future Skills Day (December 2025) or shared internally within the University (with appropriate credit to you/your organisation)?

☒Yes
☐Yes, but internal use only
☐No

7. **Are you planning to attend the Future Skills Day on the 10th of December between 10am – 2pm at the Townhouse, Penrhyn Road Campus, Kingston University London?**
   ☐Yes
   ☒Maybe
   ☐No