Industry projects 2020

**Hitachi Rail Limited**

**Week 1 (Project introduction)**

Lesson 1 AM

* Introduction to the project
  + Train manufacturing bid to meet a specific customer specification.
    - This will include designing a train and presenting it to the final customer with ‘justification of factors including design, materials, and energy sources’.

Lesson 2 PM

* Role play - interview examples to demonstrate benefit of having project work to use as an example in different scenarios.
* Weekly review: What did you learn in this session?

Outcome: Students know what they are going to be doing, why they are going to be doing it and the skills that they will develop.

**Week 2 (Design - Material)**

Lesson 1 AM

* Provide vehicle outer dimensions of railcar (2.5m wide x 25m long x 4m high).
* Task: Students to research material properties and materials that are used on high speed trains.
* Complete materials matrix with a material choice at the end of the session with written material justification.

Lesson 2 PM

* Materials testing in the Engineering Hall. Strength, flexibility, malleability
* Weekly review: What did you learn in this session?

Outcomes: Students make an informed choice of the most suitable material from which their train will be designed. They have developed their knowledge of materials and their testing.

**Week 3 (Manufacturing Layout)**

Lesson 1 AM

* Visit to the factory – Floor plan and vehicle shape to be discussed.

Lesson 2 PM

* A2 Floor Plan – Students are provided with an outer perimeter and shapes representing stations to be located within the factory; the task is to most effectively plot out the factory floor plan.
* Weekly review: What did you learn in this session?

Outcome: Students have an appreciation of the scale and logistics of the real life scenario. They have a floor plan that can be used in their presentation stand.

**Week 4 (Design – Body Design)**

Lesson 1 AM

* Main consideration: Kinematic Envelope – this must be satisfied or train may collide with trees etc. (tilting train video). Hitachi presentation
* Research task: Current train designs in the UK and in Japan (Shinkansen). Print out pictures to be used in next task.
* Make a mood board of different designs that you can use on your display.
* Begin design task: Each student produces at least one concept design.

Lesson 2 PM

* Continue with individual design.
* Choose a final design as a group.
* Make concept in 3D, students to choose material – CAD, 3D print, Foam, Cardboard, Perspex.
* Weekly review: What did you learn in this session?

Outcome: Students consider the design of trains, and using their findings, create a design, compare those designs and as a team, choose 1 to move ahead with.

Mood board for presentation.

**Week 5 (Design and build)**

Lesson 1 AM

* Continue with build of prototype.

Lesson 2 PM

* Finalise Build
* Weekly review: What did you learn in this session?

Outcome: Students have a prototype which can be used to guide conversation with industry partners on presentation day. They have developed their design skills and manufacturing skills.

**Week 6 (Power)**

Lesson 1 AM

* 10 minute presentation on current UK capabilities with OLE (Overhead Line Electrification). Only main routes have OLE.
* Research task into alternative methods of power.
* Produce a risk assessment for OLE

Lesson 2 PM

* Practical task – alternative ‘renewable’ sources of energy???

Consider suitability

Choose the most suitable energy for their train and produce a risk assessment if need.

* Weekly review: What did you learn in this session?

Outcome: Students are aware of current UK OLE capabilities, they consider alternative sources and choose a suitable energy source for their train.

**Week 7 (Assembly vs Sub-Assembly)**

Lesson 1 AM

* Students will carry out an exercise about production line efficiencies. They are required to build certain design with Lego in the quickest time possible.
* Discuss the use of a sub-assembly line to speed up the production process.

Lesson 2 PM

* Run the process again with a sub-assembly area to demonstrate the advantages of sub-assembly.
* Weekly review: What did you learn in this session?

Outcome: Students have an appreciation of lean manufacturing.

**Week 8 (Drive Systems)**

Lesson 1 AM

* Shildon visit – Positioning of drive systems and how they affect vehicle dynamics.

Lesson 2 PM

* Battery powered vehicle building exercise (the one they do at Shildon)
* Weekly review: What did you learn in this session?

Outcome: Students have a better understanding of factors that affect train motion. They use trial and improvement techniques.

**Week 9 (Vehicle Braking)**

Lesson 1 AM

* Bogie suppliers exercise; students are tasked with looking at three different bogies suppliers. All of which can supply ‘in spec’ bogies for your train, however they vary in cost, quality and performance. The task is to examine the variances and pitch which option they would like to go with long term.
* Students produce a written report which compares each different factor, cost effectiveness etc. and choose the best choice for their train. They justify that, using quantitative data where possible.

Lesson 2 PM

* Using video stimuli, students consider what might affect the stopping time / distance of a train (mass, speed, friction, leave on the line, design)
* Students consider surface finishing by completing practical which investigates the stopping distance of a vehicle on different surfaces
* Students conclude their practical result and identify considerations in train design / running which would make it as safe as possible
* Weekly review: What did you learn in this session?

Outcomes: Students qualitatively and quantitatively consider the cost effectiveness of purchasing different items for the same purpose. They consider the effect of friction, mass and speed in terms of stopping times and passenger safety.

**Week 10-11 (Presentation prep)**

* Use everything you have learned over the last ten weeks to create your presentation stand for the 3 April.
* It needs to be engaging and draw people in to talk to you so that you can explain your design,
* Create team roles and responsibilities.