R102 – The Engineered Business World

Innovations in Engineering

Instructions and answers for teachers

These instructions should accompany the OCR resource **'Innovations in Engineering'** ***activity*** *which supports OCR Cambridge Nationals in Engineering.*

The Activity:

This resource comprises of 3 tasks.

This activity offers an opportunity for English skills development.

This activity offers an opportunity for maths skills development.

Associated materials:

'Innovations in Engineering' Lesson Element learner activity sheet.

Suggested timings:

Task 1: 30 minutes **Task 2:** 30 minutes **Task 3:** 30 minutes

*Learners are likely to need access to the internet to carry out research but will have had been taught about the differing RP (*Rapid Prototyping*) technologies, innovations in materials development. The aim of this resource is to support learners' understanding of the applications and impact of technical advances in engineering.*

Learning Outcome 4: Understand innovation and technical advances in engineering

Rapid Prototyping is the term given for additive fabrication technologies, that is, automated processes that assemble a three-dimensional object from a series of nominally two-dimensional, cross-sectional layers of specialised materials.

Task 1

Research 3 different types of rapid prototyping processes and give a description of each.

Learners give answers such as;
Stereolithography (SLA) - Parts are built a layer at a time using a laser beam on the surface of a container with liquid photopolymer. The material solidifies rapidly where struck by the beam, the part is lowered gradually as each layer solidifies until the complete three-dimensional object is formed.

Fused Deposition Modelling (FDM) - A plastic filament is fed through a heated nozzle which can move in both horizontal and vertical planes. The melted plastic is deposited in a thin bead onto a platen forming the shape layer by layer.

Selective Laser Sintering (SLS) - A thin layer of powder is deposited. A laser beam is used to selectively melt and bond the material. Functional parts can be made in trial materials.

3D Printing - A layer of powder is deposited and compressed by a roller. A jet then deposits adhesive onto this powder layer and the bonded material becomes a layer of the part being formed. The platen then moves down by the depth of the layer and the process is repeated until the part is completed.

Task 2

Research the advantages of Rapid Prototyping and suggest 4 advantages for designers or manufacturers.

Learners give answers such as;

- New designs can be made and tested the same day.
- Lead in time from concept to modelling and testing/manufacture is significantly reduced. Reduced time to market.
- Design files can be sent electronically to other sites anywhere in the world for manufacture.
- Can use less materials in intricate designs negating the need for material removal processes.
- Models/prototypes can be made using a variety of materials and colours/finishes.
- Able to reduce part count and assembly by making complex parts.
- Intricate single component pieces can be made with thin walls and high degree of accuracy.
- A range of materials, metals, plastics, composites can be used.

Task 3

Increasingly composite materials are being used in engineering applications.

a) Research 3 different types of composites and suggest a use for each.

Learners give answers such as;

- Laser cured resin – used in rapid prototyping.
- Carbon fibre – panels (automotive).
- Kevlar - used as a reinforcement material for some car tyres and bicycle tyres, armour panels, in aerospace applications.

b) What are the advantages of using composites?

Learners give answers such as;

- Corrosion Resistance.
- Low-Electrical Conductivity.
- Thermal Insulation.
- High Strength-to-weight ratio.
- Strength and stiffness properties.

Engineering

Level 1/2

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