

BENT308 Exploring Machines and Systems Underpinning Principles

ECTS Value: 5 ECTS
Self-Study Hours: 64

Contact Hours: 25
Assessment Hours: 36

Overall Objectives and Outcomes

This unit builds on materials science units and investigate materials 'form of supply' available to manufacture or fabricate one-off products either as prototypes or as final products. Emphasis is given to ISO and EN standards with considerations to common materials available locally and what can practically be used at schools. This unit also covers the destructive and non-destructive testing procedures carried out by steel producers and by the steel manufacturing and fabrication industries. These topics will explain the importance to apply high level of production planning and workmanship at all stages of production when working with various materials. It also covers the basics of engineering by exploring the fundamentals of typical machines and equipment by linking physics principles to engineering. Importance is given to equipment used to generate power, produce and distribute water hence, linking engineering to today's human activities.

By the end of this module, the learner will be able to:

Competences

- a. develop a comprehensive understanding of the natural process and the engineering technologies to produce and distribute water;
- b. develop a critical understanding of the working principles of pumps and turbines, gears, gear-trains and pulleys, high and low pressures created by plane wings and propellers, the Petrol, LPG, Diesel and Fuel-Cell engines, and the generator and the motor;
- c. develop a critical understanding of renewable and non-renewable energy sources and technologies used for the conservation of energy;
- d. engage with manufacturers and market literature to critically establish the most economical material form of supply with regard to a particular product required;
- e. develop a systematic approach to enquire using standard specifications to obtain the required form of material.

Knowledge

- a. describe the geology of Malta and the natural groundwater resources;
- b. define water purification, salt water desalination, atmospheric water generation, membrane-based salinity gradient processes;
- c. describe different types of insulations used in buildings for the conservation of energy;
- d. describe a range of common pumps: Dynamic – centrifugal – axial flow, mixed flow and peripheral; Positive displacement – rotary – single rotor and multi rotor;
- e. identify abrasive grinding papers for a range of metals using the European P-Grade and the ANSI grit standards;
- f. identify the appropriate chemical and appropriate PEE to perform macro etching.
- g. describe the four stroke and the two stroke internal combustion engine, and the fuel-cell technology;

Skills

- a. Analyse from tables and graphs materials test data;
- b. Convert and transpose metric units regarding test data parameters;
- c. Carry out tests on materials at workshop level;
- d. Accomplish macro-etching of weldments to identify quality of joints;
- e. Calculate weight per metre and per unit volume for a range of materials (different density) of various cross sections.

Assessment Methods

This module will be assessed through: Practical Tasks and Write-up (50%), Research Assignment (50%)

Suggested Readings

Core Reading List:

1. Anderson, A. Shanka Saikia, I. and Ramachanfran S. (2018). Metrology and Instrumentation – KL (Metrology and Measurement – UP). India: Airwalk Publications.
2. Naunheimer, H., Bertsche, B., Ryborz, J. and Novak, W. (2011). Automotive Transmissions: Fundamentals, Selection, Design and Application. **Springer-Verlag Berlin Heidelberg**.
3. Snedden, R. (2013). Mechanical Engineering and Simple Machines (Engineering in Action). **Crabtree Publishing Company**.

Supplementary Reading List:

1. Brindley, K. (2005). Starting Electronics Construction: Techniques, Equipment and Projects. Newnes.
2. Herweck, D. (2007). All about Mechanical Engineering: Physical Science (Science Readers). US: Teacher Created Materials Publishing.
3. Oxdale, C. (2015). Making Machines with Pulleys (Simple Machine Projects). UK: Raintree Publishing.
4. Zhang, Q. (2008). Basics of Hydraulic Systems. CRC Press.
5. Scott, T.E. (1999) Power Transmission: Mechanical, Hydraulic, Pneumatic and Electrical. Pearson.
6. Porter, L. (2015). The Renewable Energy Home Handbook: Insulation & Energy, Living off-grid, Bio-mass heating, Wind Turbines, Solar Electric PV generation, Solar water heating, heat pumps and more. Veloce Publishing.
7. Bram, G. and Downs, C. (1975) Manufacturing Technology. UK: Macmillan.
8. Chapman, W.A.J. (1972). Workshop Technology: Part 1 (5th Edition), Routledge.
9. Chapman, W.A.J. (1972). Workshop Technology: Part 2 (5th Edition), Routledge.
10. Chapman, W.A.J. (1972). Workshop Technology: Part 3 (5th Edition), Routledge.
11. Devaraj, R., Ishanka S. D, and Ramachandran, S. (2018) Advanced Manufacturing Technology. India: Airwalk Publications.
12. Haslehurst, M. (1970) Manufacturing Technology. UK: English Universities Press.