Beni Suef Technological University

Material Selection for Technical Applications

Syllabus

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Course Title: Material Selection for Technical Applications

Course Code: N/A

Course Followers:

Students of Mechatronics Department in 1st semester of 2nd year

Course Meeting Times

Labs: 1 session / week, 4 hours / session

Lectures:1 lecture/ week, 4 hours / session

Course Introduction

Have you ever wondered what the products that we use every day are made of, or how each product is manufactured? Items such as washing machines, motor vehicles and games consoles are made from a range of materials that have been selected by engineers as being best suited to that product, using the most appropriate method of manufacture to ensure the product is successful. Engineers must be aware of the properties and characteristics of common technological engineering materials if they are to make good decisions about which materials and processes to use. If a product is to be commercially viable, then other factors also need to be considered, for example the materials it is made from and the manufacturing processes it

follows need to be cost-effective and sustainable. Also, engineered products need to be made to last so it's likely that they will need to be treated in some way to make sure they do. This unit will develop your understanding of material properties and characteristics and how they can be processed, as well as the applications of a range of common materials you may encounter in technological engineering. You will investigate how materials can be obtained and the methods that can be used to treat them. You will select materials and suitable manufacturing processes for different engineered products and give reasons for your choices. The knowledge you develop in this unit is essential to a production operative working in any sector of technological engineering and will contribute to your understanding of how and why products are designed and manufactured in a specific way.

Course Objectives

The goals of this course are:

1) to develop advanced understanding on the basic concepts and methodology of materials selection in mechanical design;

2) to advance better understanding on mechanical properties (i.e., fracture, fatigue, creep, deep drawability, etc.) of different materials;

3) to make materials information readily available to designers during the design process;

4) to achieve or improve on a specified product performance or eliminate a material or service failure; and

5) to solve processing difficulties and/or take advantage of new processing techniques, reduce material and/or production costs and rationalize on materials stockholding, anticipate or exploit a change in the availability of a material.

Learning Outcomes

By the end of this unit students will be able to:

1. Understand mechanical and electrical/electronic technological processes
2. Explain modern production methods
3. Choose Engineering materials
4. Implement material sustainability and forms of supply.

Prerequisites

Physics

Textbooks

There is no required textbook for this course. Useful supporting materials are listed as follows:

1.Ashby, M. F. Materials Selection in Mechanical Design, 4th ed. Burlington: Elsevier, 2011. Print.

2.Farag, M. M. Materials and Process Selection for Engineering Design, 3rd ed. Boca Raton: CRC Press, 2013, Print.

3.Ashby, M. F., Hugh Shercliff, and David Cebon. Materials: Engineering, Science,

4.Processing and Design, 4th ed. Kidlington, Oxford, United Kingdom: Butterworth-Heinemann, 2019. Print.

5.Raman, A. Materials Selection and Applications in Mechanical Engineering. New York: Industrial Press, 2007. Print.

6.Dieter, G. E. Mechanical Metallurgy, 3rd ed. New York: McGraw-Hill, 1986. Print.

7.Meyers, M. A., and Krishan Kumar Chawla. Mechanical Metallurgy: Principles and

8.Applications. Englewood Cliffs, N.J: Prentice-Hall, 1984. Print.

9.Smith, W. F. Structure and Properties of Engineering Alloys, 2nd ed. New York: McGrawHill, 1993. Print.

10. Engineering Materials: Properties and Selection, Kenneth G. Budinski, Prentice Hall, 1996

11. Materials Science and Engineering – An Introduction, William D. Callister, Jr., John Wiley

12. Engineering Design: A Materials and Processing Approach, George E. Dieter, McGraw Hill, 1991

Labs (or Tutorials/Exercise, Workshop)

· Labs will be conducted during the weeks shown in the schedule. Each lab assignment involves one or more accomplishments which must be checked off by an instructor in the lab. The instructor will be available for help and lab check-off during those weeks in which a lab is in progress.

· Students must successfully complete a series of lab assignment works throughout the course. The instructor will gather a collection of work that demonstrates evidence of a range of techniques in this course.

· Lab assignments must be done on your own. Skipping the lab and submitting work copied from someone else is a serious breach of ethics, and will be handled by the Committee on Discipline.

· Lab assignments will be graded on a scale of 0 to 3 (3: lab complete, works, good job on pre- and post-lab; 2: lab mostly complete, reasonable job on pre and post lab; 1: lab partially done, marginal to poor job on pre- and post-lab; 0: lab not done, poor job on pre- and post-lab).

Lab Books

The lab was designed from the suggested reference books and there isn't a special book for this subject

Midterm Exam

· One midterm exam for testing the learning outcomes will be given in this term. The exam will take place few days after Lab #7 for a 2-hour duration.

· Students have to demonstrate that the learning outcomes from Lab #1 to Lab#7 have been achieved.

Final Exam

· A 2-hour final exam will be given during the end-of-term exam week.

· Students have to demonstrate that the learning outcomes from Lab activities after the midterm exam had been achieved.

Calendar

The calendar provides information on the course's lab (Lab #), and exam (E) sessions.

SES #	TOPICS	KEY DATES
Lab #1	Introduction on material science	Lab report #1 in
Lab #2	Materials properties	Lab report #1 out Lab report #2 in
Lab #3	Classification of materials	Lab report #2 out Lab report #3 in
Lab #4	Ferrous metals	Lab report #3 out Lab report #4 in
Lab #5	Nonferrous metals	Lab report #4 out Lab report #5 in
Lab #6	Introduction to Stresses and strains	Lab report #5 out Lab report #6 in
Lab #7	Tensile stress and strain	Lab report #6 out Lab report #7 in
E1	Midterm Exam	

SES #	TOPICS	KEY DATES
Lab #8	Compressive stresses and strain	Lab report #7 out Lab report #8 in
Lab #9	Shear stresses and strain	Lab report #8 out Lab report #9 in
Lab #10	Torsion stresses and strain	Lab report #9 out Lab report #10 in
Lab #11	Bending stresses and strain	Lab report #10 out Lab report #11 in
Lab #12	Hardness tests	Lab report #11 out Lab report #12 in
Lab #13	Shafts design	Lab report #12 out Lab report #13 in
E2	Final Exam	

Grading (or Assessment) Policy

Initial grading will be based on the following weighting:

ACTIVITIES	PERCENTAGES
Labs (performance & reports)	60%
Midterm Exam (Practice)	20%
Final Exam (Practice)	20%

- Lab assignments will be graded on a scale of 0 to 3

  i) 3: lab complete, works, good job on pre- and post-lab;

  ii) 2: lab mostly complete, reasonable job on pre and post lab;

  iii) 1: lab partially done, marginal to poor job on pre- and post-lab;

  iv) 0: lab not done, poor job on pre- and post-lab.

- Midterm & Final Exam will be grade on a scale of 0 to 3 according to the degree of achievement in each learning outcome.

  i) 3: complete achievement in learning outcome;

  ii) 2: mostly complete, reasonable achievement in learning outcome;

  iii) 1: partially done, marginal to poor achievement in learning outcome;

iv) 0: not done, poor achievement in learning outcome.

NO.	LEARNING OUTCOME	ASSESSMENT CRITERIA
	Understand mechanical and electrical/electronic technological processes	• Reports • MCQS Quiz • Critical thinking problem • Lab experiment
	Explain modern production methods	• Reports • MCQS Quiz • Critical thinking problem • Lab experiment
	Choose Engineering materials	• Reports • MCQS Quiz • Critical thinking problem • Lab experiment
	Implement material sustainability and forms of supply.	• Reports • MCQS Quiz • Critical thinking problem • Lab experiment

· This will be followed by considerable discussion among the entire teaching staff to factor in your diligence on the labs, and your participation in class and labs. This discussion can affect your letter grade for the course, particularly if your initial grade is on a letter-grade boundary.