

Vehicle Materials and Technologies

Code: MK3JAATJ06JX20-EN

Evaluation: exam

ECTS Credit Points: 6

Semester: 3rd semester

Its prerequisite(s): Materials Engineering

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 4+4

Topics:

Properties of vehicle structure materials and technologies which influence of materials properties (heat treatment, metal forming, surface treatment). Basic concepts of metal forming processes. Flow conditions. Formable sheets. Classification of sheet metal forming technologies. Sheet metal forming processes and its technology (volume shaping, material separation processes, blanking and punching). Steps of designing of sheet metal forming tool. The theory of bending, V-shaped, U-shaped bending technology, tools. The theory of deep drawing and theoretical arrangement of deep drawing. The maximum force and power calculation to deep drawing. Designing of deep drawing tools. Special metal forming technologies. Forming of car body panels. Weldability of metals and its alloys. Classification of welding technologies. Flame welding processes, arc welding processes, shielded gas welding technologies, construction of welding equipment. Arc and machine characteristic curves. Automotive welding technologies. The role of machining in vehicle manufacturing. Classification of machining processes. Basic concepts of cutting. Cutting with a single-edged tool. Tool design, edge geometry, chip removal, chip formation, chip breaking, cutting force-, heat conditions, tool wear, tool life, quality of cutted surface. Machining processes, turning, milling, drilling, planning, chipping, abrasive processes, gearing, and thread cutting technology and their tools. Machining with irregular edges, grinding tools, grinding processes. Basic rules of gear manufacturing. Special machining, electrochemical, laser-, and water-jet cutting.

Literature:

Compulsory:

- Mikell P. Groover: Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley, 2006, ISBN: 9780471744856
- Fritz Klocke: Manufacturing Processes 1: Cutting, Springer-Verlag Berlin Heidelberg, 2011, ISBN 9783642119781
- Fritz Klocke: Manufacturing Processes 2: Grinding, Honing, Lapping Springer-Verlag Berlin Heidelberg, 2009, ISBN 9783540922599,

Recommended:

- J. T. Black, Ronald A. Kohser: DeGarmo's Materials and Processes in Manufacturing, 11th Edition, 2011, ISBN: 9780470924679

Schedule

1st week Registration week

2nd week:

Lecture: Overview of plastic deformation of sheet metals. Stresses and shape modification during plastic deformation.

Practice: Stress tensor, calculation methods, scalar and vector methods.

3rd week:

Lecture: Classification of sheet metal forming technologies. Sheet metal forming processes and its technology (volume shaping, material separation processes, blanking and punching).

4th week:

Lecture: The theory of bending, V-shaped, U-shaped bending technology, tools.

Practice: Designing of bending tools.

6th week:

Lecture: Overview of Welding Technology. The Weld Joint. Physics of Welding. Features of a Fusion-Welded Joint. Types of Arc welding

Practice: Arc welding

8th week: 1st drawing week

9th week:

Lecture: Other Fusion-Welding Processes. Solid-State Welding. Weld Quality. Weldability. Machines of welding technology

Practice: Gas tungsten arc welding (GTAW).

11th week:

Lecture: Types of manufacturing methods, chip generation process, chip types. Cutting force and cutting tool geometries. Factors of the cutting force.

Practice: Tool-geometry practice (dimensional analysis of different cutting tools)

13th week:

Lecture: Threading tools, gear manufacturing tools, grinding tools. Classification of grinding and gear production machines. Design and components analysis.

Practice: Methods to design a production technology. Calculation of basic technological parameters.

15th week: 2nd drawing week

Practice: Calculation of the minimal force to metal forming, and average stress calculation in different forming types.

5th week:

Lecture: The theory of deep drawing and theoretical arrangement of deep drawing. The maximum force and power calculation to deep drawing. Forming of car body panels

Practice: Designing of deep drawing tools

7th week:

Lecture: Energy Beam welding. (laser, electron beam, plasma) Oxyfuel gas welding. Solid state welding. Resistance Welding

Practice: Oxyfuel gas welding.

10th week:

Lecture: Surface heat treating process: carburizing, nitriding, carbonitriding. hot metal spray fusing. Equipment for heat treating operations.

Practice: Heat treatment and surface treatment of automotive steels..

12th week:

Lecture: Classification of turning machines. Classification of milling machines.

Practice: Machining Practice (on a turning machine).

14th week:

Lecture: Special technologies. Electric arc cutting, ultrasonic milling, water-jet cutting, electro-polishing.

Practice: Dimensional measuring practice.

Requirements

Attendance on the lectures is recommended, but not compulsory. Participation at practice is compulsory. Student must attend the practices and not miss more than three practice during the semester. In case a student misses more than three, the subject will not be signed and the student must repeat the course. Student can't

make up a practice with another group. The attendance on practice will be recorded by the practice leader. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, to be discussed with the tutor.

During the semester there are two tests: the mid-term test is in the first drawing week and the end-term test in the 2nd drawing week. Students have to sit for the tests. If the score of any test is below 60%, the student once can take a retake test covering the whole semester material.

B, for grade:

The course ends with an exam, the grade is calculated as:

- 60% from the exam
- 20%-20% from the two tests

The minimum requirement for passing is 60%, the grade for the final mark is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)