**Nazwa przedmiotu:**

Manufacturing Technology

**Koordynator przedmiotu:**

Prof. Piotr Skawiński PhD, DSc

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia I stopnia

**Program:**

Electric and Hybrid Vehicles Engineering

**Grupa przedmiotów:**

Obowiązkowe

**Kod przedmiotu:**

1150-00000-ISA-0119

**Semestr nominalny:**

2 / rok ak. 2022/2023

**Liczba punktów ECTS:**

3

**Liczba godzin pracy studenta związanych z osiągnięciem efektów uczenia się:**

1) Number of contact hours - 50, including;
a) laboratory- 45 h;
b) consultations – 5 h.
2) Student’s individual work - 20 h, including:
a) 25 h – literature studies and preparation for classes;
3) TOTAL – 75.

**Liczba punktów ECTS na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:**

2 ECTS points – number of contact hours - 50, including:
a) lecture- 45 h;
b) consultations – 5 h.

**Język prowadzenia zajęć:**

angielski

**Liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym:**

Brak

**Formy zajęć i ich wymiar w semestrze:**

|  |  |
| --- | --- |
| Wykład:  | 45h |
| Ćwiczenia:  | 0h |
| Laboratorium:  | 0h |
| Projekt:  | 0h |
| Lekcje komputerowe:  | 0h |

**Wymagania wstępne:**

Without prerequisites

**Limit liczby studentów:**

According to the order of the Rector.

**Cel przedmiotu:**

Acquiring knowledge about cutting tools, basic machining process, cutting economics, classification of machining processes and advanced machining techniques. Gaining skills about setting or calculating cutting data. Acquiring knowledge about casting materials and classifical of casting process. Gaining experience in casting design and selection of appropriate casting method. Acquiring knowledge about welding, soldering and brazing. Gaining knowledge about theory of plasticity, metal forming, forming methods and forming machines. Acquiring competences about ability to individual work and work in a team.

**Treści kształcenia:**

1. Definition of machining. Chipless forming as alternative of machining. Short history of manufacturing technology. Typical workpiece materials. 2. Cutting tools. Types and characteristics. Tool materials. Coatings. 3. Basic machining process. Cutting conditions: cutting speed, feed rate and the depth of cut. Chip formation and chip classification. Cutting forces and power. Heat in cutting. Cutting fluids: functions, types, safety concerns and degradation. Tool wear . Tool life curve. 4. Cutting economics. Economic tool-life and tool-life at maximum production rate. Production rate vs cutting speed curve and machining cost vs cutting speed curve. Machining cost vs tolerance curve. Selection of cutting speed, feed rate and the depth of cut dependent on production rate, cost, tolerance and stage (roughing or finishing) in cutting. 5. Classification of machining processes (turning, drilling, milling, sawing, broaching) and machining tools. Finish machining: grinding, honing, lapping, polishing. Advanced machining techniques: electric discharge machining (EDM), electro-chemical erosion, laser cutting, water jet cutting. CNC machining. Trends in cutting practice. 6. Basic process. Casting materials. Design requirements of casting (draft, the gating system, parting surface, shrinkage). Pattern, moulding box, moulding materials, flask, core and core box. Moulding machines. 7. Classification of casting process: sand casting, permanent mould casting, investment casting (lost-wax casting), lost-foam casting, die casting (hot-chamber machines and cold-chamber machines), centrifugal casting (rotocasting) and shell-mould casting. 8. Casting defects and remedies. 9. Gas welding. Oxyacetylene blowpipe. 10. Electric arc. Arc welding: manual metal arc welding (MMA), metal inert gas welding (MIG), tungsten inert gas welding (TIG), flux-cored arc welding (FCA). and submerged arc welding (SAW). Welding joint types. Plate edge preparation. 11. Industrial application of welding. Advantages and disadvantages of welding. Classification of welding machines. 12. Laser beam welding. Plasma arc welding (PAW). Electron beam welding. 13. Electric resistance welding. Friction stir welding. Ultrasonic welding. Explosion welding. 14. Soldering and brazing. 15. Hardfacing and thermal spraying. 16. Different materials weldability depending on type of welding process. Welding defect: mayor causes, type of cracks, distortion. Welding joints quality control systems. 17. Short theory of plasticity and metal forming. Typical stress vs. strain diagram with the various stages of deformation. Flow curve. Definition of: dislocation slip, twinning deformation, work hardening, recrystallization temperature and recovery. 18. Material behaviour in metal forming. Temperature in metal forming: cold, worm and hot working. Friction and lubrication in metal forming. 19. Forging, rolling, extrusion, sheet metalworking: bending, deep drawing and shearing (die cutting), press forming. 20. Forming machines (rolling mill, forging machine, press, drawing machine, swaging machine) and tools. 21. Design of forming manufacturing system (groups of machines or production line).

**Metody oceny:**

3 tests (Machining, welding and casting, plastic forming)

**Egzamin:**

nie

**Literatura:**

Modern Metal Cutting. A practical handbook. Sandvic Coromant, 1994 Rao P.N: Manufacturing Technology. Foundry, Forming and Welding. Tata McGraw-Hill Publishinh Company Ltd., 2007

**Witryna www przedmiotu:**

Brak

**Uwagi:**

Brak

## Efekty przedmiotowe

### Profil ogólnoakademicki - wiedza

**Efekt 1150-00000-ISA-0119\_W1:**

Has knowledge in the area of the basic of mechanical egineering: 1)cutting operations, cutting parameters, cutting tools, tool wear and machine tools, 2)casting materials, casting processes, casting defects and remedies, 3) welding: gas welding, electric arc welding, advantages and disadvantages of welding, laser beam welding, 4)plastic forming: basic information about plasticity and metal forming, material behaviour in metal forming, forging, rolling, extrusion, sheet metalworking: bending, deep drawing and shearing, forming machines.

Weryfikacja:

Tests

**Powiązane efekty kierunkowe:** K\_W11, K\_W17

**Powiązane efekty obszarowe:** T1A\_W02, T1A\_W03, T1A\_W03, T1A\_W04, T1A\_W07

### Profil ogólnoakademicki - umiejętności

**Efekt 1150-00000-ISA-0119\_U1:**

The student is able to choose and determine the cutting parameters, primarily for turning and milling. He can select machine tools, casting methods, plastic forming methods and joining methods depending on the type of material, accuracy requirements and production volume.

Weryfikacja:

Tests

**Powiązane efekty kierunkowe:** K\_U24

**Powiązane efekty obszarowe:** T1A\_U15

**Efekt 1150-00000-ISA-0119\_U2:**

The student can: in a very simplified way, design a pig iron; he can indicate the causes of weld joint damage and indicate methods for preventing their formation; he can indicate the causes of damage to components produced by plastic forming technologies and provide methods to prevent their formation

Weryfikacja:

Tests

**Powiązane efekty kierunkowe:** K\_U15

**Powiązane efekty obszarowe:** T1A\_U12, T1A\_U16

### Profil ogólnoakademicki - kompetencje społeczne

**Efekt 1150-00000-ISA-0119\_K1:**

The student can be, as a future engineer, responsible for reliable knowledge acquisition.

Weryfikacja:

Assessment of activity and involvement in lectures and consultations as well as strict elimination of collections

**Powiązane efekty kierunkowe:** K\_K03

**Powiązane efekty obszarowe:** T1A\_K05