



UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet:	Tehnike hlajenja
Subject Title:	Cooling technics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
FIZIKA PHYSICS		1 ali 2	1 ali 2

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45	30				375	15

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lecture:	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian
	Vaje / Tutorial:	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Predznanje iz klasične in moderne fizike, termodinamike.

Prerequisites:

Basic knowledge of classical and modern physics, thermodynamics.

Vsebina:

1. Osnove hlajenja in gretja:
procesi hlajenja in gretja v T,s; p,v; logp,h; e,h in h,x diagramih, lastnosti hladilnih sredstev ,
2. Kompresorski hladilni sistemi:
realni kompresorski hladilni proces v T,s; p,v; logp,h; e,h diagramih, večstopenjski in kaskadni hladilni sistemi
3. Toplotne črpalke:
sistemi toplotnih črpalk voda-voda in voda –zrak
4. Absorpcijski in adsorpcijski hladilni sistemi:
absorpcijski in adsorpcijski procesi v h,x diagramih, večstopenjski sistemi
5. Philipsov plinski hladilni stroj:
Joule-Thompsonov efekt, Lindejev proces, Stirlingov proces
6. Elektromagnetni hladilni sistemi
7. Termoelektrični hladilni sistemi na osnovi Peltierjevega efekta
8. Magnetno-kalorični hladilni sistemi
9. Polprevodniško hlajenje na osnovi Etinghaussenovega efekta

Content (Syllabus outline):

1. Fundamentals of cooling and heating:
cooling and heating processes in T,s; p,v; logp,h; e,h in h,x diagrams, refrigerants properties
2. Compression cooling systems:
real compression cooling cycle in T,s; p,v; logp,h; e,h diagrams, multi stage and cascade colling system
3. Heat pumps:
Heat pumps water-water and air-water
4. Absorption and adsorption cooling systems:
Absorption and adsorption cycles in h,x diagrams, multistage systems
5. Philips cooling machine:
Joule-Thompsonov effect, Lindejev cycle, Stirlingov cycle
6. Electromagnetic cooling systems
7. Thermoelectric cooling systems based on Peltier cycle
8. Magnetic-thermal cooling systems
9. Semiconductor cooling systems based on Etinghaussen effect

Temeljni literatura in viri / Textbook:

Milan Marčič, Jurij Avsec, Hladilna tehnika, Fakulteta za strojništvo, Univerza v Mariboru, 2003
 Faye McQuiston, Jerald Parker, Jeffrey Spitler, Heating, Ventilating and Air-Conditioning, John Wiley&Sons 2000
 G. K. White, Experimental techniques in low temperature physics, Clarendon Press, Oxford 1989.
 John Howell, Richard Buckius, Fundamentals of Engineering Thermodynamics, McGraw-Hill Book Company, 1987
 A. Bejan, Advanced engineering thermodynamics, John Wiley&Sons, 1997
 A. L. Fetter, J. D. Walecka, Quantum theory of many-particle systems, McGraw-Hill, 1971

Cilji:

Študent si pridobi poglobljena teoretična in uporabna znanja o tehnikah hlajenja in gretja.

Objectives:

Students acquire advanced theoretical and practical knowledge of cooling and heating systems.

Predvideni študijski rezultati:

Znanje in razumevanje:
 Poglobljeno teoretično razumevanje različnih hladilnih tehnik.

Prenesljive/ključne spretnosti in drugi atributi:
 Poglobljeno teoretično znanje o tehnikah hlajenja je mogoče uporabiti za projektiranje hladilnih sistemov.

Intended learning outcomes:

Knowledge and Understanding:
 Advanced theoretical knowledge and understanding of various cooling technics

Transferable/Key Skills and other attributes:
 Advanced theoretical knowledge and understanding of cooling technics can be used for designing of cooling systems.

Metode poučevanja in učenja:

Predavanja, seminar, izdelava projektne naloge.

Learning and teaching methods:

Lectures, seminar, to work out project work.

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

projektna naloga

50 %

project

ustni izpit

50 %

oral examination