COURSE DESCRIPTION CARD - SYLLABUS

Course name
Data storage systems

Course

Field of study
computer science
Area of study (specialization)
Data Processing Technologies

Intelligent Information Technologies
Level of study
Second-cycle studies
Form of study
full-time

Year/Semester
1/2
Profile of study
general academic
Course offered in
polish
Requirements
elective

Number of hours

Lecture
30
Laboratory classes
Other (e.g. online)
Tutorials
Projects/seminars
30

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
Tomasz Bilski, BEng, PhD

Responsible for the course/lecturer:
Michał Apolinarski, BEng

Prerequisites

Student should have basic knowledge on: IT systems, including operating systems, basics of computer networks. Student should have abilities for information accessing from given sources and should be prepared to work in a team.

Course objective

Providing students with knowledge on models, architecture and operation of devices and systems for longterm data storage. Providing students with skills related to storage systems modelling, designing and testing.

Course-related learning outcomes

Knowledge

Student has detailed knowledge on:

- storage media structure and operation (including magnetic, optical, flash) and storage systems for longterm data storage,

- interfaces, buses and communication protocols used in data storage systems,

- network based data storage systems (including: NAS, SAN, IP storage),

- methods and rules for stored data protection.

Skills

Student can:

- provide assumptions, concept and design for data storage system including solutions based on computer networks,

- perform analysis of structure and operation of longterm data storage system,

- fulfill requirements related to high data security level.

Social competences

Student understands that:

- using IT tools must be law compliant,

- one of important IT system aspects is data protection,

- it is necessary to update knowledge about particular tools and systems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Theoretical knowledge is verified during 45-minute test performed last lecture. Test consists of 8 questions. To achieve positive result student should get more than 50% of points. Test topics are provided to students by email at the beginning of the semester.

Practical skills are verified during classes (related to particular design phases) and by assessment of final project and its documentation.

Programme content

Lecture

1. Introduction – storage media classification and parameters (capacity, BER, efficiency, life time), including flash, magnetic, optical), logical data organization (formating , bad sectors, partitions, FAT, NTFS, HPFS). Barriers, trends and prospects of development.

2. Storage buses (ATA, SATA, SCSI, SAS, FC, NVMe, Infiniband).

3. Magnetical storage media, magnetic writing, data organization. Magnetic disks. Tape storage (helical, linear modes), standards (QIC, DLT, SDLT, LTO).

4. Optical storage media (technology, data coding, data organization), standards (CD, DVD, Blu-ray, holography).

5. Solid state storage media (flash, SSD).

6. Backup. Backup schemas, backup servers, HSM (Hierarchical Storage Management), ILM, deduplication.

7. Storage system virtualization. Massive storage in computer networks (NAS, SAN, VSAN). IP storage. Cloud storage: models (including object storage model), examples (including: Amazon Simple Cloud Storage Service).

8. Communication protocols for network storage systems: iSCSI, FCIP, IFCP.

9. Storage system security – media durability, system reliability. Irreversible data deletion. Legal aspects of data storage.

Project

Assumptions. Concept (including selection of: storage media, interfaces, buses, system architecture) designing, implementation, testing of data storage system. Preparation of system documentation. Security level verification. Project created with a use of modern technologies.

Concept of a network data storage system for a selected environment. Analysis of the selected environment and preparation of assumptions for the system. Selection of appropriate storage media, interfaces, storage buses, system architecture, protocols, network devices, software, backup systems, archiving and permanent deletion of data in the designed system. Preparation of documentation of the designed system. System security assessment. Project created with a use of modern technologies.

Teaching methods

Interactive lecture (with questions for students) with a use of multimedia presentation. Files with slides provided to students.

Project in the form of consultation and verification of each design phases. Tasks performed in teams of 2 students with a use of computer hardware, software and Internet.

Bibliography

Basic

T. Bilski, Pamięć: nośniki i systemy przechowywania danych, WNT, Warszawa, 2008 (in Polish, PUT Library signature: W 119644).

J. W. Toigo, Zarządzanie przechowywaniem danych w sieci, Helion, Gliwice, 2004 (in Polish, PUT Library signature: W 109697).

S. Nelson, Profesjonalne tworzenie kopii zapasowych i odzyskiwanie danych, Helion, 2012 (in Polish, PUT Library signature: W 135831).

Additional

Z. Fryźlewicz, D. Nikończuk, Windows Azure. Wprowadzenie do programowania w chmurze, Helion, 2012 (in Polish).

P. Metzger, A. Jełowicki, Anatomia PC, Wyd. Helion, Gliwice, 1998 (in Polish)

F. Schmidt, SCSI i IDE. Protokoły, zastosowania i programowanie, Mikom, 1999 (in Polish).

T. Bilski, Quantitative Risk Analysis for Data Storage Systems, 20th International Conference, CN 2013 Proceedings, [A. Kwiecień, P. Gaj, P. Stera, Editors] Communications in Computer Science and Information Science 370, Springer Verlag, Heidelberg, 2013, s. 124-135.

T. Bilski, Network Storage Systems with IPSec Implementations, Information Systems Architecture and Technology, Networks Design and Analysis, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2012, 127-136

Breakdown of average student's workload

	Hours	ECTS
Total workload	130	5,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for tests, project and documentation preparation) [1]	70	2,5

[1] delete or add other activities as appropriate