



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Operacijski sistemi
Course title: Operating Systems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Enovit magistrski študijski program druge stopnje Predmetni učitelj	/	5.	9
Five-year master's degree program Subject Teacher	/	5.	9

Vrsta predmeta / Course type

Izbirni / Elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45		2	28		105	6

Nosilec predmeta / Lecturer:

Božidar Potočnik

Jeziki /

Languages:

Predavanja /

Lectures:

slovenščina / Slovenian

Vaje / Tutorial: slovenščina / Slovenian

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

Prerequisites:

Vsebina:

- Uvod: vloga operacijskega sistema (OS) ter njegove temeljne funkcije, zgradba računalniških sistemov in OS, delo s prekinitvami in z vhodni-izhodnimi napravami.
- Upravljanje s posli in procesi: posel in njegovo izvrševanje, zgradba in stanja procesa, procesov nadzorni blok, niti, komunikacija med procesi.

Content (Syllabus outline):

- Introduction: role of operating systems (OS) and their basic functionality, computer systems and OS architectures, interrupt handling and access to input/output devices.
- Job and process management: jobs and their scheduling, process structure and states, process control block, threads, process communication.

- Razvrščanje procesov: kriteriji za razvrščanje, razvrščevalni algoritmi (kdor prej pride, prej melje, najkrajši posli najprej, prioriteta, krožna prioriteta, več aktivnih vrst).
- Upravljanje s posli: dvonivojsko in trinivojsko razvrščanje poslov, izločanje procesov.
- Sinhronizacija med procesi: kritični odsek, Petersonova rešitev za sinhronizacijo med dvema procesoma, pekarniški algoritem, strojni pripomočki za sinhronizacijo, semafor, monitor, problem popolnega zastoja in pomanjkanja.
- Klasični problemi sinhronizacije: proizvajalec in potrošnik, pisci in bralci, filozofi pri kosilu, speči brivec.
- Upravljanje s pomnilnikom: particije, ostranjevanje, izvedbe tabel strani, asociativni pomnilnik, segmentiranje, segmentiranje z ostranjevanjem, učinkoviti dostopni časi.
- Virtualni pomnilnik: postopki nalaganja in zamenjave strani, napaka strani, algoritmi za zamenjavo strani in učinkoviti dostopni časi (kdor prej pride, prej melje, optimalni, najdlje neuporabljeni, števnici).
- Upravljanje z zbirčnim sistemom: kazala in njihova izvedba (večnivojska, drevesna, aciklični grafi), funkcije OS pri delu z zbirkami in kazali, sloji zbirčnega sistema.
- Izvedbe zbirčnega sistema: fizični zapisi zbirk v obliki sklenjenega zapisa, kazalčnega seznama in indeksne namestitve, NTFS.
- Razvrščanje zahtev za disk: algoritmi (kdor prej pride, prej melje, prebirni, ciklični prebirni, multimedijski), upravljanje s prostim diskovnim prostorom in z odlagalnim prostorom.

- Process scheduling: scheduling criteria, scheduling algorithms (first-come first-served, shortest-job-first, priority, round-robin, several active queues).
- Job management: two- and three-level scheduling, process suspension.
- Process synchronisation: critical section, Peterson's solution for synchronisation of two processes, bakery algorithm, hardware for synchronisation, semaphore, monitor, the problem of deadlock and starvation.
- Classical problems of synchronisation: producer-consumer, readers and writers, dining philosophers, sleeping barber.
- Memory management: partitions, paging, page table design, associative registers, segmentation, segmentation with paging, effective access times.
- Virtual memory: loading and replacement algorithms, page fault, page replacement algorithms and effective access times (first-come first-served, optimal, least-recently-used, counting).
- File system management: directories and their implementation (multilevel, tree, acyclic graphs), functions of OS to handle files and directories, levels of file system.
- Implementation of file systems: physical allocation of files as contiguous, list of pointers and indexing, NTFS.
- Disk scheduling: algorithms (first-come first-served, scan, cyclic scan, multimedia), disk free-space and swap-space management.

Temeljni literatura in viri / Readings:

- D. Zazula: *Operacijski sistemi*, Univerza v Mariboru, Fakulteta za elektrotehniko, računalništvo in informatiko, Maribor, 2008.
- A. Silberschatz, P. B. Galvin, G. Gagne: *Operating System Concepts*, John Wiley & Sons, Hoboken, 2003.
- W. Stallings: *Operating systems*, Eight Edition, Prentice Hall, Upper Saddle River, 2014.

- M. Russinovich, D. A. Solomon, A. Ionescu: Windows Internals, Microsoft Press, Redmond, 2012.
- A. S. Tanenbaum, H. Bos: Modern Operating Systems, Prentice Hall, Boston, 2014.

Cilji in kompetence:

Predmet podaja temeljna znanja o osnovi in delovanju operacijskih sistemov.

Objectives and competences:

This course gives basic knowledge of operating systems design and algorithms.

Predvideni študijski rezultati:**Znanje in razumevanje:**

Po zaključku tega predmeta bo študent sposoben

- razumeti glavne principe načrtovanja in delovanja operacijskih sistemov,
- analizirati in uporabiti algoritme za razvrščanje in sinhronizacijo procesov ter za upravljanje s pomnilnikom in z zbirčnimi sistemi,
- optimalno namestiti operacijski sistem in uporabljati njegove funkcije.

Prenosljive/ključne spretnosti in drugi atributi:

- *Spretnosti komuniciranja:* ustni zagovor laboratorijskih vaj, priprava in javna predstavitev poročila o študentskem projektu, ustni izpit.
- *Uporaba informacijske tehnologije:* delo z različnimi operacijskimi sistemi, pisanje krajših sistemskih programov.
- *Delo v skupini:* skupinsko delo v študentskem projektu.
- *Reševanje problemov:* načrtovanje in izvedba študentskega projekta, sodelovanje z industrijskimi partnerji.

Intended learning outcomes:**Knowledge and understanding:**

On completion of this course the student will be able to

- understand the basic principles of the operating systems design and operation,
- analyse and re-implement the algorithms for process scheduling and synchronisation, and for memory and file-system management,
- install and set-up the operating system and use its functions.

Transferable/Key skills and other attributes:

- *Communication skills:* oral lab work defence, preparation and presentation of the student project report, oral examination.
- *Use of information technology:* use of different operating systems, implementation of plain system programs.
- *Team work:* team execution of student projects.
- *Problem solving:* designing and implementing of student projects, co-operation with industrial partners.

Metode poučevanja in učenja:

- predavanja,
- seminarske vaje,
- laboratorijske vaje,
- seminar,
- reševanje domačih nalog.

Learning and teaching methods:

- lectures,
- tutorials,
- lab work,
- tutorial,
- homework assignments.

Načini ocenjevanja:Delež (v %) / **Assessment:**
Weight (in %)

<ul style="list-style-type: none"> • opravljene domače naloge, • laboratorijske vaje, • opravljeno seminarsko delo, • 1. vmesni pisni izpit, • 2. vmesni pisni izpit, • 3. vmesni pisni izpit. 	15 % 35 % 15 % 11 % 12 % 12 %	<ul style="list-style-type: none"> • completed homework, • lab work, • completed seminar work, • 1st midterm written exam, • 2nd midterm written exam, • 3rd midterm written exam.
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Opomba: Če študent ni uspešno opravil vseh treh vmesnih pisnih izpitov, jih nadomesti z ustnim izpitom v deležu 35%.

Note: If a student has not completed all three midterm written exams, he replaces them with an oral exam in the weight of 35%.

Reference nosilca / Lecturer's references:

<ul style="list-style-type: none"> • PODBREZNIK, Peter, POTOČNIK, Božidar. Assessing the influence of temperature variations on the geometrical properties of a low-cost calibrated camera system by using computer vision procedures. Machine vision and applications, ISSN 0932-8092, 2012, vol. 23, no. 5, str. 953-966. • MLAKAR, Uroš, POTOČNIK, Božidar. Automated facial expression recognition based on histograms of oriented gradient feature vector differences. Signal, image and video processing, ISSN 1863-1703, Dec. 2015, vol. 9, suppl. 1, str. 245-253. • PODBREZNIK, Peter, POTOČNIK, Božidar. A self-adaptive ASIFT-SH method. Advanced engineering informatics, ISSN 1474-0346, Jan. 2013, vol. 27, iss. 1, str. 120-130. • PODBREZNIK, Peter, POTOČNIK, Božidar. Dense feature matching method based on ASIFT : the building-site monitoring case. Saarbrücken: Lap Lambert, cop. 2013. 57 str., ilustr. ISBN 978-3-659-50022-0. • ŠAVC, Martin, POTOČNIK, Božidar. Colour constancy using grey edge framework and image component analysis. Transactions on internet and information systems, ISSN 1976-7277, Dec. 2014, vol. 8, no. 12, str. 4502-4512.
