2016-06-27 - E&T Selected topics in mathematics, exam

electronics and telecomunication II.1. [45 lectures, 45 classes]

Exam, the 1st term: Monday 27nd of June, CW-1, Polish: 8:00-9:30, English: 9:45-11:15.
The 2nd term: Monday 26th of September, CW-10, Polish: 8:00-9:30, English: 9:45-11:15.

1. There is a written exam. A student who does not submit his/her answers in the 1st term loses it.
2. According to university regulation, I have to keep, for a year, answers you give, they are official documents. They have to be submited on standard A4 (210×297 mm) blank sheets (light chequer and lining are also admitted), the first exam page has to follow the pattern (the scoring table may list more than 5 problems, e.g. 7 ones for this exam):

2016-06-27
Selected topics in mathematics
2.1, term 1

FAMILY_NAME PERSONAL_NAME
album number
group/specialization

A		/9
B		/9
C		/9
D		/9
E		/9
sum		/27
mark		

3. In case when your replies are not clearly identified (there is advised to start each answer on a new page) and legible, they will be not read; this results with stating that a student did not become, and in the eProto (the electronic system where students' marks are stored) it is signalized as *nieobecny*=absent.
4. The time to provide answers is at least 60 minutes (it does not include the time when questions are presented) and no more than 75 (the elongation will be announced about 50 minutes after the exam starts).
5. In the exam there will offered a couple of questions/problems (at least five ones). Every student chooses three of them, in the table he/she left uncrossed boxes intended for points exposed by the examiner. Only three chosen problems undergo evaluation, every answer within the range 0-9 points. The sum of points determines the final mark:
   00–12: **2.0**; 13–15: **3.0**; 16–18: **3.5**; 19–21: **4.0**; 22–24: **4.5**; 25–27: **5.0**.
6. Every student has the right to see, at scheduled time (announced in the exam), how his/her answers are assessed. For this exam this right is guaranteed thanks to student's presence when I check answers, namely on Wednesday, June 22nd, 11:00-16:00, CM-101 (and the approximate time is passed to each student individually).
7. Accordingly to rules announced in the beginning of the semester, the examiner may rise up or push down the mark resulted from the exam (e.g., there can be taken into account an activity, statements demonstrating a lack of knowledge). In particular, it concerns the case when the written exam makes the first part of the whole exam (and this does not applies to the exam in the 1st term, because this is no oral examination at all).
8. Every student should control whether his/her mark is correctly saved in the eProto system. When detecting any abnormality he/she has to immediately alarm the examiner about the case (e.g., by e-mail, always specifying his/her full name, album number, group, and the name of the course). In scheduled time the eProto closes and there is no possible to eliminate any mistakes.
9. A student gaining on exam 11 or 12 points may be proposed to answer immediately to one more question, and this can be the reason to shift his/her mark up to 3.0. A student gaining less than 11 points can not obtain this opportunity.
10. A student has to copy formulations of three chosen problems (and may copy formulations of all proposed questions).
11. A student who does not undergo examination, or who failed (this is, is evaluated with two marks 2), may continue his/her studies if he/she collects enough scores (at least 18 out of 30 completing the whole in one semester) in other courses; then he/she is expected to pass positively the exam in maths till the end of September 2017.
12. Every student who passed positively the course (or other courses covering the material trained in the course the exam concerns, in Poland or abroad) may ask for being no examined. This way to approve the course is called a *mapum* (marking after the previous university marks, documented with a provided copy of a proper transcript issued by the education institution). When applied, it results with **3.0** (if he/she gained 3.0-3.5, E or D, 51-75/100) or **3.5** (if he/she was scored with 4.0-5.0, C-A, 76-100/100).
    A student has to claim for the mapum before the examiner starts to evaluate his/her answers, and has to state it expressively on the first or the last exam sheet. Despite this statement the examiner may verify answers and may score the student at hand accordingly to the mark resulted from just read answers, but can not approve the course if answers exhibit the student 's ignorance in topics the exam questions deal with (recall that a student gives answers to problems he/she consider best dominated).

2016-06-27, 8:00–9:30 [czas udzielania odpowiedzi 70 minut], CW-1 NAZWISKO IMIĘ
EiT. Wybrane działy matematyki album no. ……
Egzamin, 1szy termin grupa ….

Student wybiera trzy spośród zaproponowanych siedmiu zagadnień (od A do G). Treść tych trzech zagadnień przepisuje. Ocenie podlegają tylko odpowiedzi na wybrane pytania, każde w zakresie 0-9 punktów. Suma punktów wyznacza ocenę za egzamin:

00–12: **2.0**; 13–15: **3.0**; 16–18: **3.5**; 19–21: **4.0**; 22–24: **4.5**; 25–27: **5.0**.

Student(ka), którego/której pracy nie przejrzałem, może zaliczyć przedmiot według kryterium *mapum* (*marking after the previous university marks*), jeśli już uzyskał zaliczenie: po wręczeniu mi kopii odpowiedniego dokumentu i wyrażeniu, na piśmie, stosownego życzenia uzyskuje 3.0 (gdy legitymuje się oceną 3, 3.5, 51–75/100, E lub D) albo 3.5 (zamiast 4–5, 76–100/100, C, B lub A).

Ocenioną pracę student(ka) może przejrzeć w piątek, 1.VII 12:00-15:00, a także w czasie mych dyżurów w lipcowe środy i czwartki 9:45-11:15 (E-744). Adam Marlewski, PP

A1–3		/9
B1–3		/9
C1–3		/9
D1–3		/9
E1–3		/9
F1-3		/9
G1–3		/9
suma		/27
stopień		

A1. Przytocz definicje pary elementów, iloczynu kartezjańskiego, relacji i relacji równoważności.
A2. Podaj nietrywialne przykłady relacji równoważności.
A3. Podaj definicję funkcji i przykłady odwzorowań, które nie są funkcjami w klasycznym rozumieniu (np. w zbiorze liczb zespolonych).

B1. Napisz, co to jest norma elementu przestrzeni liniowej/wektorowej.
B2. Podaj przykłady norm wektorowych i norm macierzowych.
B3. Przedstaw oszacowanie błędu rozwiązania zaburzonego uralu, przy tym objaśnij wielkości występujące w tym oszacowaniu.

C1. Co to są para własna i równanie charakterystyczne macierzy. Uzasadnij związek między tym równaniem a widmem macierzy.
C2. Co znaczy, że macierz ma pełne widmo ? Wypowiedz się o diagonalizacji macierzy o pełnym widmie.
C3. Udowodnij twierdzenie dotyczącej w.w. diagonalizacji.

D1. Podaj definicje anihilatora i wielomianu minimalnego macierzy oraz krotności minimalnej.
D2. Sformułuj twierdzenie Cayleya-Hamiltona.
D3. Pokaż, jak wyznacza się exp(*At*), gdy *A* = $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$.

E1. Zapisz definicję jawnego r.r.1.r. (ODE1) i omów dwa zjawiska przez nie opisywane.
E2. Pokaż, jak w dwuparametrowym równaniu Verhulsta można pozbyć się jednego parametru.
E3. Pokaż, jak w jednoparametrowym równaniu Verhulsta można ten parametr wyeliminować.

F1. Utwórz r.r.z.2.r. (ODE2s) opisujące przepływ prądu w szeregowym obwodzie RLC.
F2. Przedstaw, jak się uzyskuje ogólne rozwiązanie (CORJ) tego równania i jak uzyskuje się rozwiązanie spełniające warunki brzegowe.
F3. Przekształć rozwiązanie ogólne do postaci ujawniającej funkcje trygonometryczne.

G1. Co to jest r.r.cz.2.r (PDE2). Wymień i nazwij typy tego równania.
G2. Napisz, a także uzyskaj, rozwiązanie d'Alemberta równania falowego.
G3. Przedstaw, co to jest rozwiązanie fourierowskie zagadnienia początkowego-brzegowego (dla) kanonicznego równania falowego.

2016-06-27, 9:45–11:15 [time to response: 70 minutes], CW-1 FAMILY_NAME NAME
E&T. Selected topics in mathematics album no. ……
Exam, 1st term

Student chooses three of seven problems (A through G), and copy their formulations. Only these 3 items undergo evaluation, every one within the range 0-9 points. The sum of points determines the final mark:

00–12: **2.0**; 13–15: **3.0**; 16–18: **3.5**; 19–21: **4.0**; 22–24: **4.5**; 25–27: **5.0**.

If answers are not examined, then there can be applied the *mapum* (marking after the previous university marks, documented with a copy of a proper transcript, provided to me, and an explicit demand expressed in writing). This results with **3.0** or **3.5** (when marks are or 3, 3.5, E-D and 51-75 or 4–5, C-A and 76-100, in Polish, international and 100-point scale, resp.).

Every student may see his/her checked work on Friday, July 1st, 12:00-15:00,
as well as on every July Wednesday and Thursday, 9:45-11:15, in the room E-744.

A1. Define the notions 'a scalar product of functions' and 'orthogonal system of functions'.
A2. List and characterize 4 classical families of orthogonal polynomials.
A3. Describe how specific orthogonal polynomials appear in some physical phenomenon.

B1. Explain the notion 'a collocative/collocation polynomial',
present five particular bases used in collocation.
B2. Formulate the theorem on the uniqueness
of the polynomial collocation problem.
B3. Prove this theorem.

C1. Cite definitions of an eigenpair and of a characteristic equation
(CE) of a matrix. Ground the relation between eigenvalues and CE.
C2. Say what the notion 'similar matrices' mean.
Formulate the theorem on the spectrum of similar matrices.
C3. Prove this theorem.

D1. Say what a stochastic matrix is. Discuss its spectrum.
D3. Present a Markov process and a transition matrix.
Provide, also graphically, an example with a matrix of order 3.
D4. Discuss the stabilization of the system described by this matrix.

E1. Describe the physical experiment known as a Newton cooling problem,
and form an appropriate ODE1.
E2. Solve this equation.
E3. Present, also graphically, the solution to the IVP for the problem at hand.

F1. Start with physical laws and form ODE2 describing a parallel RLC system.
F2. Show the way to find its general solution (GIHE) when no excitement takes place,
and to get the solution to BVP for an homogeneous ODE2.
F3. Transform a GIHE into an expression clearly exhibiting trigonometric functions.

G1. Give canonical forms and name types of PDE2, associate them to eigenvalues.
G2. Present d'Alembert solution to a wave equation and derive it.
G3. Discuss Fourier solution to BIVP for the canonical wave equation.

A1–3		/9
B1–3		/9
C1–3		/9
D1–3		/9
E1–3		/9
F1-3		/9
G1–3		/9
sum		/27
mark		

Adam Marlewski, PP