Mathematics MSc for Civil Engineers - BMEEODH90MX33

I. Tantárgyleírás

1. Alapadatok

1.1 Tantárgy neve

Mathematics MSc for Civil Engineers

1.2 Azonosító (tantárgykód)

BMEEODH90MX33

1.3 Tantárgy jellege

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	28
Gyakorlat	14

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Vizsga

1.6 Kreditszám

3

1.7 Tárgyfelelős

név	Balázs Bárány
beosztás	Egyetemi docens
email	balubs@math.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Dékáni hivatal

1.9 A tantárgy weblapja

https://epito.bme.hu/BMEEODH90MX33
https://edu.epito.bme.hu/course/view.php?id=3444

1.10 Az oktatás nyelve

magyar és angol

Mathematics MSc for Civil Engineers - BMEEODH90MX33

1.11 Tantárgy típusa

Kötelező a Szerkezet-építőmérnök (MSc) szakon

1.12 Előkövetelmények

1.13 Tantárgyleírás érvényessége

2017. szeptember 1.

2. Célkitűzések és tanulási eredmények

2.1 Célkitűzések

1. Linear algebra: linear equation systems, Gauss-Jordan elimination, finite dimensional vector spaces, linear independence, generator, basis, basis transformation matrix, linear transformations, basis representation, determinant, inverse of matrices, eigenvalues, eigenvectors, scalar product, symmetric matrices, Gram-Schmidt orthogonalization, trace, quadratic forms, fundamental subspaces of matrices, rank, nullity, orthogonal complement of subspaces, matrix of orthogonal projection, method of least squares, positive definite matrices, singular value decomposition, polar decomposition, spectral decomposition.
2. Partial differential equations: Fourier-sine series, vibrating string problem for finite and infinite strings, Bernoulli's and D'Alambert's solution, heat transportation problem on finite rod.
3. Vector Analysis: line integral, work, conservative vector fields, potential function, curl-test in two and three dimensions, surface integral, flux, Gauss' divergence theorem, Stoke's theorem, Green's theorem.

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése utána a hallgató

A. Tudás

1. The students knows the basic definitions of vector spaces, linear independence, generators, basis and the connections between them.
2. The student knows the basic definitions related to linear transformations. The inverse, basis transformations, orthogonal projections, eigenvalues, eigenvectors, determinant.
3. The students knows advanced properties of linear transformations, the rank, fundamental subspaces, nullity.
4. The student knows the properties of symmetric matrices, positive definite matrices, the spectral decomposition and singular value decomposition.
5. The student knows the partial differential equation of heat transport and vibrating string, the methods of solutions by Bernoulli and D'Alambert.
6. The student knows the basic definitions of the vector fields, line integral, gradient, potential, conservative, and the curl.
7. The student knows the surface integral of vector fields and the related Gauss', Stokes' and Green's Theorem.

B. Képesség

1. The student is able to solve linear equations independently. Calculate the determinant, eigenvalues, eigenvectors and inverse of a matrix.
2. The student is able to determine the fundamental subspaces of a linear transformation, the rank, and the nullity.
3. The student is able to find orthogonal projections to a given subspace and solve equations with the

method of least squares.
4. The student is able to determine the singular values and the singular value decomposition.
5. The student is able to solve the partial differential equation of the one dimensional vibrating string by using Bernoulli's solutions. The student is able to solve the partial differential equation of the one dimensional vibrating string by using D'Alamabert's solutions.
6. The student is able to solve the partial differential equation of heat transport of a rod with 0 boundary condition.
7. The student is able to determine whether a vector field is conservative and able to find the potential function.
8. The student is able to calculate the work of a vector field on a curve.
9. The student is able to calculate the flux of a vector field on a surface.

C. Attitűd

1. The student cooperates with the teacher and fellow students in expanding the knowledge.
2. The student is constantly acquiring his/her knowledge,
3. The student seeks to learn the system of tools needed to solve mathematical problems.
4. The student strives for a transparent, accurate and error-free solution.
5. The student strives for the consistent application of mathematical knowledge in solving technical problems.

D. Önállóság és felelősség

1. The student independently thinks through mathematical exercises and problems and solves them based on given sources.
2. The student openly accepts substantiated critical remarks.
3. The student takes a systemic approach to its thinking.

2.3 Oktatási módszertan

The lectures and exercises form together an integral whole. The theoretical discussion of each topic takes place together with the solution of the practical tasks presenting the applications.

2.4 Részletes tárgyprogram

Week	**Topics of lectures and/or exercise classes**
1.	Gauss elimination, vector spaces, linear independence, basis,
2.	basis transform, linear transformation, determinant
3.	eigenvalues, eigenvectors, scalar product, orthogonal matrices, symmetric matrices, Gram-Schmidt orthogonalization,
4.	trace, quadratic form, Gauss-Jordan elimination,
5.	fundamental subspaces, dimension theorems, orthogonal

	projections,
6.	method of smallest squares, positive definite matrices, singular values, polar decomposition, spectral decomposition,
7.	Fourier-series, sine Fourier-series, vibrating string, Bernoulli's solution,
8.	D'Alambert's solution, infinite length rod, Heat equation
9.	midterm test
10.	vector analysis, line integral, conservative fields,
11.	Curl-test on plane, on space, potential function, surface integrals,
12.	retaken midterm test
13.	Gauss' theorem, Stokes' theorem
14.	Green's theorem, surfaces

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

Contemporary Linear Algebra Howard Anthon, Robert C. Buasby Wiley, 2003, ISBN 0-471-16362-7Fourier Analysis, T.W. Körner, Cambridge, 1988, ISBN 0 521 38991 7Excercises for Fourier Analysis, T.W. Körner, Cambridge 1993 ISBN 43849 7

2.6 Egyéb tudnivalók

2.7 Konzultációs lehetőségek

Jelen TAD az alábbi félévre érvényes:

Inactive courses

II. Tárgykövetelmények

3. A tanulmányi teljesítmény ellenőrzése és értékelése

3.1 Általános szabályok

There is one midterm test during the semester, which is 45 minutes long. During the examination period there will be written exams of length 100 minutes.

3.2 Teljesítményértékelési módszerek

Evaluation form	Abbreviation	Assessed learning outcomes
Midterm	MT	A.1-A.5; B.1-B.5; C.3-C.5; D.1-D.3
Exam	E	A.1-A.7; B.1-B.9; C.3-C.5; D.1-D.3

A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Abbreviation	Score
MT	60
E	90
Sum	**100%**

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

Those students can get the signature for the semester, who had at least 30% (i.e. 18 points) score on the midterm test. The criterion for the exam is the signature for the semester.

3.5 Érdemjegy megállapítása

Grade	Points (P)
excellent (5)	125-150
good (4)	105-124
satisfactory (3)	90-104
passed (2)	75-89
failed (1)	0-74

3.6 Javítás és pótlás

If someone failed on the midterm test or wants to increase the score, there will be one retaken midterm test on the 12th week.

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/semester
Preparing for midterm	20
Preparing for exam	28
Lectures and seminars	42
Sum	**90**

3.8 A tárgykövetelmények érvényessége

2017. szeptember 1.

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Inactive courses