

MATH 100 - Mathematics for Artificial Intelligence

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| DIVISION/DEPARTMENT: | Laney - Division of Math & Science / L - Mathematics | BOARD OF TRUSTEES APPROVAL DATE: | 04/25/2023 |
| ORIGINATOR: | Shaposhnikov, Nick | STATE APPROVAL DATE: | 04/28/2023 |
| STATE CONTROL #: | CCC000637721 | CURRICULUM COMMITTEE APPROVAL DATE: | 02/14/2023 |
| | | REQUISITE VALIDATION: | |
| | | CURRENT EFFECTIVE DATE: | 08/01/2023 |

1. REQUESTED CREDIT CLASSIFICATION:

COURSE TYPE: D - Credit - Degree Applicable

CB08 BASIC SKILL STATUS (PBS STATUS): N - Not Basic Skills

CB24-PROGRAM COURSE STATUS: 2 - Not Program Applicable

2. DEPT/COURSE NO:

MATH 100

3. COURSE TITLE:

Mathematics for Artificial Intelligence

4. COURSE:

Laney New Course

TOP NO.: 1701.00 - Mathematics, General

5. UNITS:

Variable No

Units (Min) 5.000

Min Total

Lecture Hours (Min) 5.000

87.5

Lab/Studio/Activity Hours (Min) 0.000

0

Units (Max)

Max Total

Lecture Hours (Max)

0

Lab/Studio/Activity Hours (Max)

0

6. SELECTED TOPIC:

NO. OF TIMES OFFERED AS SELECTED TOPIC:

AVERAGE ENROLLMENT:

7. JUSTIFICATION FOR COURSE:

Provides Mathematical foundation for Artificial Intelligence - "the most promising career" by LinkedIn and the "best job in America" by Glassdoor.

8. COURSE/CATALOG DESCRIPTION:

Probability, Statistics, Linear Algebra, and Calculus for AI: Descriptive and Inferential Statistics, Vector Spaces, Decomposition and Diagonalization, SVD (Singular Value Decomposition) and PCA (Principal Component Analysis), Single Variable and Partial Differentiation, Gradient Descent Optimization.

9. OTHER CATALOG INFORMATION:

a. Modular: No

If yes, how many modules:

b. Open entry/open exit: No

c. Grading Policy: Letter Grade Only

d. Eligible for credit by Exam: No

e. Repeatable according to state guidelines: No

f. Required for degree/certificate (specify):

g. Meets GE/Transfer requirements (specify):

h. C-ID Number:

Expiration Date:

i. Are there prerequisites/corequisites/recommended preparation for this course? No

10. LIST STUDENT PERFORMANCE OBJECTIVES (EXIT SKILLS):

1. Define data types and provide examples
2. Explain the difference between population and sample
3. Describe measures of "Central Tendency"
4. Describe measures of Dispersion
5. Describe Normal and Standard Normal distributions
6. Present Central Limit Theorem
7. Compare Descriptive and Inferential Statistical methods
8. Describe "Confidence Interval" method
9. Describe "Hypothesis Testing"
10. Define vectors and matrices
11. Define vector space and linear mapping
12. Define inner product, orthogonality, and orthonormal basis
13. Define Eigenvalues and Eigenvectors
14. Define Decomposition and Diagonalization
15. Compare Singular Value Decomposition (SVD) and Principal Component Analysis (PCA)
16. Define a derivative of a single-variable function
17. Define Partial Derivative
18. Describe a concept of Gradient

19. Present a general Calculus optimization procedure
20. Describe Gradient Descent method of machine learning from Mathematical point of view

11. COURSE CONTENT:

LECTURE CONTENT:

1. Probability and Statistics specific to AI (40%):
 - Data Types
 - Population & Sample, Population Parameter vs Sample Statistic
 - Measures of Central Tendency (mean, median, mode) and Dispersion (Range, Variance, SD)
 - Binomial trials and Probability density function
 - Normal & Standard normal distributions
 - Central Limit Theorem
 - Method of Moments
 - Maximum of likelihood
 - Bayes/ Estimators
 - Confidence Interval
 - Hypothesis Testing
 - Independence Test
 - ANOVA
 - Python for Statistics and AI
2. Linear Algebra specific to AI (40%):
 - Systems of Linear Equations
 - Vectors and Matrices
 - Vector Spaces
 - Linear Mapping
 - Inner Products
 - Orthogonality and Projections
 - Orthonormal Basis
 - Eigenvalues and Eigenvectors
 - Decomposition and Diagonalization
 - Singular Value Decomposition and Principal Component Analysis
 - LU and QR Decompositions
 - Python for Linear Algebra and AI
3. Calculus specific to AI(20%)
 - Differentiation of Univariate Functions
 - Partial Differentiation
 - Gradient
 - Optimization Using Gradient Descent
 - Point Estimate Optimization

LAB CONTENT:

n/a

12. METHODS OF INSTRUCTION:

- Lecture
- Multimedia Content
- **Other Methods:** Depending on different styles and preferences of the instructors, some of them may choose to include Observation and Demonstration, Discussions, Forums, Online Conferencing, Projects, Individualized Instruction, and more.

13. ASSIGNMENTS:

Out-of-class Assignments (List all assignments, including library assignments. Requires two (2) hours of independent work outside of class for each unit/weekly lecture hour. Outside assignments are not required for lab-only courses, although they can be given.)

Override Outside Class Hours: No

Outside-of-Class Hours (Min): 10.000

Outside-of-Class Hours (Max): 0.000

Override Outside-of-Class Hours (Min):

Override Outside-of-Class Hours (Max):

Out of class Assignment:

1. Problem sets, which are relevant to the content and levels of difficulty presented in the lectures
2. Quizzes and/or examinations

14. STUDENT ASSESSMENT:

- COMPUTATION SKILLS
- NON-COMPUTATIONAL PROBLEM SOLVING (Critical thinking should be demonstrated by solving unfamiliar problems via various strategies.)
- SKILL DEMONSTRATION
- MULTIPLE CHOICE
- OTHER (Describe)
- **Other:** Depending on the various teaching styles of the instructors, some of them may choose to include Online Verbal Examination, Anti-cheating Assessment (blocking online solvers, traceable identification of the questions), Multiple Choice, Matching, Calculated Multiple Choice, Multiple Answer, True/False, Drag & Drop, Multipart

Question, Conditional Multipart Question, Scenarios and Simulations, Decision-making Exercises, and more.

15. TEXTS, READINGS, AND MATERIALS:

A. Textbooks:

Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong. *Mathematics for Machine Learning*. 1st edition Cambridge University Press, 2020.

*Date is required: Transfer institutions require current publication date(s) within 5 years of outline addition/update.

B. Additional Resources:

Library/LRC Materials and Services:

The instructor, in consultation with a librarian, has reviewed the materials and services of the College Library/LRC in the subject areas related to the proposed new/updated course

Print Materials were reviewed? Yes

Non-Print Materials were reviewed? Yes

Online Materials were reviewed? Yes

Services were reviewed? Yes

Specific materials and/or services needed have been identified and discussed. Librarian comments:

Library requests list of recommended non-textbook supplementary titles to support this course. Send recommendations to Autumn Sullivan asullivan@peralta.edu

C. Readings listed in A and B above are:

Primarily college level

16. DESIGNATE OCCUPATIONAL CODE:

CB09 SAM Code: E - Non-Occupational

17. LEVEL BELOW TRANSFER:

CB21 Levels Below Transfer: Y - Not applicable

18. CALIFORNIA CLASSIFICATION CODE:

CB11 California Classification Codes: Y - Credit Course

19. NON CREDIT COURSE CATEGORY:

Y - Not Applicable, Credit course

20. FUNDING AGENCY CATEGORY:

CB23 Funding Agency Category: Y - Not Applicable (funding not used to develop course)

REQUISITES AND ADVISORIES:

None