DSML - 3850 - Cloud Computing

05. UG New Course No Special Designation

Due Dates and Resources

If you have questions or need assistance in filling out this proposal form, you may contact the Office of Curriculum.

Deadlines for curriculum can be found:

- Curriculum SharePoint
- Curriculum Website
- Procedural Calendar
- On your Curriculog dashboard under 'My Upcoming Events'

Resources for curriculum can be found:

- Originator How-To Guide
- Curriculum SharePoint

In order to meet the deadline, this proposal must be on the *Substantive College/School Level Review* step on or before the listed due date.

Directions for Form

General Instructions and Information

You may collapse individual sections of this form by clicking the arrow or "V" icon to the right of the section title.
All fields that are marked with an asterisk (*) are required.
Each section may have additional directions attached. Please follow all instructions.

Note: Proposals that are incomplete or filled out incorrectly will be returned to the originator.

INSTRUCTIONS FOR CREATING A NEW COURSE

Fill out all of the below fields.
Launch the proposal.
Approve the proposal.

Use the checkmark icon on the right of the screen to approve the proposal.

This form **SHOULD** be used only for the following:

- Creating a new course without a special designation (General Studies, Service Learning, Multicultural, or Senior Experience).

This form **SHOULD NOT** be used for the following:

- Creating a new course with a special designation (General Studies, Service Learning, Multicultural, or Senior Experience).
- Converting an omnibus or individual variable topic course into a regular course. Please use form #4 to complete this request.
- Making modifications to any course
- Creating or modifying graduate courses.

Part I: Department and Originator Information

College / School: *

College/School: College of Aerospace, Computing, Engineering, and Design

Department:* Department of Computer Sciences

Name of Proposal Originator:* Steve Geinitz

Email of Proposal Originator:* geinitz@msudenver.edu

Part II: Curriculum Proposal Justification and Resource Implication

Justification and resource implication for proposed curriculum action:*

Cloud computing is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing. It allows companies and organizations to quickly set up services and applications with global reach without the need to invest large amounts of capital in data centers, equipment, and software.

Due to the flexibility and cost savings offered by cloud computing, it has become the preferred platform for running applications in the most diverse domains, including commercial, scientific, data science and artificial intelligence. This course aims to introduce the most important aspects related to cloud computing, including virtualization, security, load balancing, redundancy, auto scaling, and serverless computing.

Related Curriculum Proposals:* DSML Degree Program - https://msudenver.curriculog.com/proposal:10946/form

According to the Undergraduate Curriculum Manual, it is the responsibility of both the originator as well as each level of review to consider potential overlap and curriculum conflict. Any potential overlap or conflict with existing curriculum should be reviewed, and the impacted department(s) should be requested to provide a letter of notification or support, depending on the circumstances.

Attach documentation that supports affected Departments were notified and/or provided support of the proposed changes in the Proposal Toolbox by clicking on the paperclip icon on the right side of the form.

Please Confirm That:* ☑ I, the originator of this proposal, have completed the necessary due diligence to review this proposal for any potential overlap and/or conflict with existing curriculum. Any departments identified as having potential overlap and/or conflicts have been contacted and a letter of notification and/or a letter of support has been obtained.

Part III: Course Information

Is the identified course prefix a new course prefix? * ☑ Yes ☐ No

Prefix:* DSML

Course Number:* 3850

Course Title:* Cloud Computing

Transcript/Banner Course Title:* Cloud Computing

Course Type:* Computer Science

CIP Code: 11.0701

Please check all that apply from the selections below. You may select more than one option if applicable.

Check All that Apply:*
- [x] Required for Major
- [ ] Required for Minor
- [ ] Required for Concentration
- [ ] Required for Certificate
- [x] Elective
- [ ] Specified Elective

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

Federal Credit Hour Definition: *A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:*
(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of- class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward to the award of credit hours. 34CFR 600.2 (11/1/2010)

Credits:* 4

Distribution of Credits:* 4 + 0

Schedule Type(s):* Lecture

Grade Mode(s):* Letter

Face-to-Face or Equivalent Hours per course

Consult Appendix B and C of the Curriculum Manual to determine the hours for the course

Lecture: 50

Lab:

Internship:

Practicum:

Other Hours:

Additional Student Work Hours: 120

Please answer yes or no to the below questions. If you answer yes to any of the questions, please fill out the related field on the right.

A specified repeatable course is a course that allows a student to repeat the course either in its entirety or for a certain identified total number of credit hours. If you decide to make your course repeatable, please specify either how many times a student can repeat the course for credit, or for the total number of credits they can receive.

Is this course a specified repeatable course?* (•) No ( ) Yes

If yes, indicate specified repeatable number of credits and/or repeats allowed:

Is this course a variable topics umbrella course?* (•) No ( ) Yes

If yes, indicate variable topic number of credits and/or repeats available:

A crosslisting is when a course is made available under additional prefixes for students in other programs.

An equivalency is when two courses are coded in Banner to be equal to each other.

Generally equivalencies are used when an old, archived course is needed to be equal to a new course. Crosslistings are used for all active courses. Supporting documentation should be included to demonstrate approval for crosslistings.

Are there course equivalencies?* (•) No ( ) Yes

If yes, list all equivalent courses in alphabetical order:

Will this course be requesting a crosslisting with any other prefix(es)?* (•) No ( ) Yes

If yes, list all crosslistings in alphabetical order:

Registration Restrictions

Program:

Major:

Level: Undergraduate

Class:

Student Attribute:

The following fields will allow you to attach prerequisites, corequisites, or prerequisites or corequisites to your course. Please specify if you want and of these prerequisites, corequisites, or prerequisites or corequisites Banner enforced.

Banner enforcement means that the requirement will be enforced when the student attempts to register for a course. If you do not Banner enforce the requirement, the system will not check the student's record for the requirement to be met.

Please also indicate the minimum passing grade.

Prerequisite(s):	CS 3250
Banner Enforced Prerequisite(s):	CS 3250
Minimum Passing Grade for Banner Enforced Prerequisite(s):	C- or T
Corequisite(s):	
Banner Enforced Corequisite(s):	
Prerequisite(s) or Corequisite(s):	
Banner Enforced Prerequisite(s) or Corequisite(s):	
Minimum Passing Grade for Banner Enforced Prerequisite(s) or Corequisite(s):	

Part III: Course Information, continued

Catalog Course Description:* In this course students learn how to utilize the on-demand delivery of IT resources provided by Cloud Computing to quickly set up software services and applications. Through assignments and projects students create the necessary data and software services to run applications in diverse domains including data science and machine learning. Additional topics covered include virtualization, security, load balancing, redundancy, auto scaling, and serverless computing.

The note field DOES show up in the course listing in the university catalog. A note should be made in specific instances where additional information about a course needs to be conveyed to students. The most common reasons for adding a note are:

The course is crosslisted Example: *(Note: Credit will be granted for only one prefix.)*
Variable credit courses Example: *(Note: Variable Credit)*
A course is repeatable Example: *(Note: This course may be repeated up to 3 times under different topics)* OR *(Note: This course is repeatable for a maximum of six semester hours)*
If a student cannot take two courses and earn credit for both Example: *(Note: Students cannot earn credit for XXX1234 and XXX2345)*

Note:

Lab Fees: **Field Trips:**

Part III: Course Information, continued

The following section is the course content. You must adhere to the following format for each section:

Required reading: Please list materials in preferred citation style (eg. MLA, APA, etc.).

List each material in this format. If there are multiple materials please format them in a bullet or list style

Specific Measurable Student Behavioral Learning Objectives: Please list the SBLOs in your preferred numbering or bulleting style. Start section with: Upon completion of this course, the student should be able to:.
Detailed Outline of Course Content or Outline of Field Experience/Internship: Please list the course outline in your preferred numbering or bulleting style. It is recommended that you use a numbering format for this field.
Evaluation of Student Performance: Please list the evaluation of student performance in your preferred numbering or bulleting style.

You must use the numbering list feature within the toolbar above each field. Right click on a number in the list and select "Numbered List Properties" to change the numbering style. Please maintain consistency in the selected numbering or bulleting styles.

Required reading and other materials will be equivalent to:*

Bahga, A. and Madisetti, V., *Cloud Computing: A Hands-on Approach*.

Manjunath, G. and Sitaram, D. *Moving to The Cloud: Developing Apps in the New World of Cloud Computing*. Syngress.

Odun-Ayo, I. *Basics of Cloud Computing and Machine Learning.*

Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)

Cloud Computing 2018 (1986726282)

Ahead in the Cloud: Best Practices for Navigating the Future of Enterprise IT

Specific, Measurable Student Behavioral Learning Objectives:*

Upon completion of this course students should be able to:

1. Design cloud computing architectures that satisfy an application's set of requirements.
2. Choose the most appropriate virtualization model based on user requirements.
3. Design serverless distributed applications to solve a range of problems.
4. Implement multi-tier applications in the cloud that meet availability, scalability, and security requirements.
5. Implement a data science pipeline in the cloud to solve machine learning problems.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship *

1. Overview
    1. Definition
    2. Motivation and Applications
    3. Characteristics
    4. Cloud Computing Models
2. Networking
    1. Overview
    2. Addressing and Routing
    3. Naming and DNS Services
    4. Transport Services
    5. HTTP Protocol
3. Security
    1. Users and User Groups
    2. Roles
    3. Policies
    4. Network Security
    5. Data Security
4. Virtualization
    1. Definition
    2. Server Virtualization
    3. Application Virtualization
    4. Storage Virtualization
    5. Network Virtualization
5. Serverless Computing
    1. Introduction
    2. Push & Pull Invocation Models
    3. Queues & Connectors
    4. Applications
6. Multi-Tier Application Architecture
    1. Overview
    2. Implementation
    3. Availability
    4. Load Balancing
    5. Auto Scaling
7. Data Science Pipeline
    1. Overview

2. Data Engineering
3. Exploratory Data Analysis
4. Modeling
5. Implementation

Evaluation of Student Performance:* Student evaluations can include asessments of the following types:

1. Homework - exercises involving cloud computing tasks and concepts
2. Projects - complete cloud computing tasks to set up services and software systems
3. Quizzes/Exams - formative and summative assessments
4. Participation/Engagement - presentations, groups work, and discussions

Academic Affairs and Registrar's Office Use Only

Notes

Curriculum and Reporting Specialist corrected the format of the outline and evaluation of student.

Director corrected CIP code.

This new course will be effective for the University 2024-2025 Undergraduate Catalog and will be available in Banner beginning in Fall 2024.

Form Revised July 2022