DO NOT TYPE IN THIS BOX

Bulletin # : _____

Academic Year : _____

FLORIDA INTERNATIONAL UNIVERSITY
UNIVERSITY CURRICULUM COMMITTEE
Proposal for a New Course

1. **School/College** College of Engineering and Computing

   Div./Dept. in Which Taught Knight Foundation School of Computing and Information Sciences

2. | CTS | 4 | 375 | | 3 |
   |---|---|---|---|---|
   | **Alpha Prefix** | **1st Digit** | **Last 3 Digits** | **"C"-lec-lab "L"-Lab** | **Cr. Hrs.** |

   CIP Code ***(Leave this blank):*** _____

3. **Grading Method (select one):** ☒ Graded ☐ Pass/Fail

4a. **Course Title** Cloud Infrastructure and Services

b. **Abbreviated course Title** ***(for computer class schedules, transcripts)*** Cloud Infra & Services

LIMITED TO 25 Characters *(including spaces)*

5. **Statewide Course Numbering Subject Matter Area** Computer Technology and Skills

6. **Catalog Description/Major Topics** *(not to exceed 200 characters including spaces)*

College of Medicine and College of Law: Attach description not exceeding 1,000 characters including spaces.

Helps students develop deep technical expertise in cloud computing and prepares them for a Solutions Architect certification exam with a major cloud provider.

7. **Attach detailed syllabus course outline and course justification on separate page(s).**
8. **Prerequisite(s):** (CTS-3145 or equivalent cloud certification) and (CGS-4285 or CNT-4713 or equivalent course)
9. **Corequisite(s):** None
10. **Objective(s) of Course:**

Students will learn the business security and compliance considerations in Cloud Computing, migrating to the cloud, architecting applications in the cloud, and how to troubleshoot cloud services.

11. **Does this course duplicate/overlap other courses at FIU?** ☒ No ☐ Yes

    If yes, please explain: None

12. **What other closely related department(s) have been consulted about this course?**

    Electrical and Computer Engineering

13. **Is this course used for the assessment of a program or a certificate (if yes, then send a notification to assessment@fiu.edu)?** ☑ **No** ☐ **Yes**

PROPOSAL REQUESTED BY:

Faculty Contact Nagarajan Prabakar _____ / _____ / 20_____
(Type name) **(Signature)**

prabakar@fiu.edu 305-348-2033
(Email address) **(Phone number)**

Chairperson (Dept./Div.) Jason Liu _____ / _____ / 20_____
(Type name) **(Signature)**

Chairperson (Curr. Comm.) Alexander Afanasyev _____ / _____ / 20_____
(Type name) **(Signature)**

College/School Dean Ines Triay _____ / _____ / 20_____
(Type name) **(Signature)**

Submit one original form. Attach one copy of the course justification and a draft of the course syllabus for this New Course Proposal. *The complete syllabus should include all components listed on the New Course Checklist.*

New Course Proposal Guidelines

The following serve as guidelines when reviewing for approval of a New Course proposal. Please follow each step to assure the completion of this form.

Cover Page (titled): Florida International University Curriculum Committee Proposal for a New Course

1. Visit the Faculty Senate Website: Make sure that the cover page/curricular forms are the **most updated** on the Faculty Senate website under "**Curriculum Other Forms."**
2. Note on the form that the effective date is specified by the Faculty Senate – University Curriculum Calendar facultysenate.fiu.edu (e.g., bulletin 1-3 is the following fall, bulletin 4-6 is the Spring of the next academic year)
3. Common Errors /Recommendations in completing the Form:
    - Select a grading method (Graded or Pass/Fail)
    - The course description must be limited to 200 characters (including spaces and symbols)
    - Course objectives may be presented as "see attached syllabus" instead of typing in the box.
4. All supporting documents should be included (e.g., email to assessment office, email(s) communication with other departments on duplication/overlap with existing FIU courses)
    - Question 13: Does this proposed change impact the assessment process of a program or certificate? This question refers to the student learning outcomes of a degree program and the specific courses used to gather student artifacts to access critical thinking, communication, content knowledge, etc. Typically, courses that reflect culminating experiences of a degree are identified in the assessment plan.
5. Insert the justification in front of the syllabi, which clearly and accurately describes the rationale for the course.

Syllabus

1) Required Syllabus Components: (Generic Syllabus not specific to any semester)
    a) Course Prefix, number, and full name as stipulated on the new course form.
    b) Prerequisites and co-requisites (if any are included on the New Course form).
    c) Course Description: The description from the New Course form must be reflected (but does not have to be verbatim) . A detailed description is acceptable to provide students with a more specific course overview.
    d) Objectives/Learning Outcomes: Include student learning outcomes and ensure that they are written using measurable verbs (e.g., Bloom's Taxonomy). Note that the Faculty Senate review Curriculum process includes determining the course outcomes reflecting the higher-level learning of a college course (lower division, upper division, graduate).
    e) Required purchases, including texts (ISBN), lab supplies, artistic supplies, and professional and ancillary items. If there is no required text, a preliminary list of readings should be included to reflect the depth of learning expected of students. Texts/readings should be from valid sources and timely.
    f) Grading standards to be used in calculating final grades.
    g) A tentative outline that includes essential topics in a weekly format along with anticipated week due dates: assignments, performances, artistic submissions, and examinations.
    h) Performance measures for evaluation in awarding final grades. The description of the significant assignments should reflect appropriate rigor for the course level (lower division, upper division, graduate).
    i) Any instructor and department policies that may impact a student's enrollment or final grade.

The following documents can assist with ensuring that the submitted syllabus meets all the requirements:

2020-2021 Faculty Handbook (Pages 33-36)

Syllabi Requirements

Policy and Procedures Library - 300.010 Course Syllabi Requirements

CTS 4375 Cloud Infrastructure and Services

Course Justification

Cloud Computing has become the norm rather than the exception in terms of how major corporations host their IT infrastructure. It is estimated that well over 90% of companies use cloud computing services, and almost all have plans for continued expansion. The global Cloud Computing market size is now over $500 billion annually, with estimates putting it over $1 Trillion annually within five years. Most IT professionals will need to learn cloud technologies to continue working in the industry. Thus, new graduates, particularly those in the IT program, should acquire these Cloud Computing skills while in FIU to make them more marketable once they graduate. In addition, certifications are important within the industry to prove to employers that you have the required knowledge of the platforms they utilize. Creating a course focused on a deeper understanding of cloud technologies and the acquisition of secondary-level certification from a Cloud Computing industry leader would be a tremendous benefit to our students.

The intent of this course is to help students develop a deep technical expertise in cloud computing and prepare them for a Solutions Architect certification exam with a major cloud provider. Students will learn the business security and compliance considerations in Cloud Computing, migrating to the cloud, architecting cloud applications, and troubleshooting cloud services. Students will be exposed to industry-leading cloud administration portals and learn how to use them effectively to create standard infrastructure patterns per best practices.

School of Computing and Information Sciences

Course Title: Cloud Infrastructure and Services **Date:** 12/24/2023

Course Number: CTS-4375

Number of Credits: 3

Subject Area: Systems	**Subject Area Coordinator:** Gregory Reis **email:** gmuradre@fiu.edu
Catalog Description: Helps students develop deep technical expertise in cloud computing and prepares them for a Solutions Architect certification exam with a major cloud provider.	
Textbook: None – Public information reading suggestions plus instructor created content	
References: "AWS Certified Solutions Architect Study Guide with 900 Practice Test Questions: Associate (SAA-C03) Exam (4th Edition)", Ben Piper, David Clinton. ISBN-10: 1119982626. ISBN-13: 978-1119982623. Sybex.	
Prerequisites Courses: (CTS-3145 or equivalent cloud certification) and (CGS-4285 or CNT-4713 or equivalent course)	
Corequisites Courses: None	

Type: Elective for CS (Systems), IT (System Network), & CY Majors

Prerequisites Knowledge:

- Basic Programming Knowledge
- Networking, Security & Operating System Knowledge (Linux & Windows)
- Basic Cloud Computing Knowledge

Course Outcomes:

1. Recognize the business essentials required to implement and support a cloud deployment. [Remembering]
2. Explain the technical essentials of a specific provider's cloud environment (e.g., Management console, networking/compute/storage/database options, etc.). [Understanding]
3. Demonstrate how to plan and design a specific provider's cloud architecture (e.g., Identifying architectural options, making architectural decisions based on business requirements, Incorporating best practices, etc.). [Understanding]
4. Implement a solution to a specific provider's cloud infrastructure using automation including monitoring, ongoing maintenance, and cost estimations. [Applying]
5. Apply cybersecurity best practices in cloud deployments. [Applying]
6. Compare and contrast the many disaster recovery & resiliency options in the cloud. [Analyzing]

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CTS-4375
Cloud Infrastructure and Services

Association between Student Outcomes and Course Outcomes

BS in Computing: Student Outcomes	Course Outcomes
1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	1, 2, 3, 4, 5, 6
2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	1, 3, 4, 5, 6
3) Communicate effectively in a variety of professional contexts.	4, 5
4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	
5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	4, 5

Program Specific Student Outcomes

6) Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]	
6) Apply security principles and practices to maintain operations in the presence of risks and threats. [CY]	5, 6
6) Use systemic approaches to select, develop, apply, integrate, and administer secure computing technologies to accomplish user goals. [IT]	1, 2, 3, 4, 5, 6

Assessment Plan for the Course and how Data in the Course are used to assess Student Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: https://abet.cis.fiu.edu/

School of Computing and Information Sciences
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Cloud Infrastructure and Services

Outline

Topic	Lecture Hours	Outcome
• Cloud Architecting Overview • The "Well Architected Framework" • Best Practices in cloud architecting • AWS Global Infrastructure	2	1,3
• Storage, Compute & Database cloud options • Object, file & volume storage • IaaS options • RDBMS, NoSQL & Graph DB options	6	2,3,4
• Networking in the cloud • Virtual private cloud options • Peering networks • Integrating with private networks	6	2,3,4
• Security in the cloud • Accounts, groups, and roles • Security policies • Federation	6	2,3,4,5
• Implementing Elasticity, High Availability, & Monitoring in the cloud • Scaling Compute & Databases • Designing for High Availability • Implementing Monitoring	6	2,3,4,6
• Automation & Content Caching • Using Cloud vendor specific IAC tools (e.g., CloudFormation, Beanstalk) • Edge Caching • Database Caching	6	2,3,4,6
• Building decoupled microservice applications • Decoupling strategies • Queuing & Notifications • Container options • Functions as a service • API Gateway	6	2,3,4,6
• Planning for a disaster • Disaster recovery planning strategies • Disaster recovery patterns	2	2,3,4,6

Learning Outcomes: (Familiarity → Usage → Assessment)

Pervasive Themes in IT:

1. Explain how the components of an IT system interrelate. [Assessment]
2. Explain how and why complexity occurs in IT. [Familiarity]
3. Manage complexity in an information technology environment by applying best practices and using appropriate technologies and methodologies. [Familiarity]

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IAS Fundamental Aspects:

1. Give examples of how IT system components (e.g., servers, routers, people, software) can be countermeasures, vulnerabilities, and also threats. [Assessment]
2. Explain and give examples of why information assurance and security must be "built in" to design and architecture from the beginning to be most effective. [Familiarity]
3. Describe a disaster recovery scenario. [Familiarity]

Security Mechanisms (Countermeasures):

1. Explain the three key factors involved in authentication and how they are used to verify identity and grant access to a system. [Assessment]
2. Explain the process and value of two-factor authentication. [Familiarity]
3. Explain the differences between symmetric and asymmetric cryptosystems, e.g., number of keys required, the types of algorithms used, etc. [Assessment]
4. Explain how public key infrastructure (PKI) works. [Familiarity]

Information Management Concepts and Fundamentals

1. Explain the role of data, information, and databases in organizations. [Familiarity]
2. Explain basic issues of data retention, including the need for retention, physical storage, security. [Familiarity]
3. Explain why data backup is important and how organizations use backup and recovery systems. [Assessment]

Managing the Database Environment:

1. Explain the concept of database security. [Familiarity]
2. Explain the concept of replication as it pertains to distributed databases. [Familiarity]
3. Describe the concept of web services and the role of SOAP. [Assessment]

IPT Intersystem Communications

1. Describe and contrast the different types of architectures for integrating systems. [Familiarity]
2. Describe the purpose of message and queuing services and how they work and list the protocol used by one messaging service (e.g., JMS). [Assessment]

Computing Infrastructures:

1. Classify and describe the various types of servers and services required within organizations. [Assessment]

Foundations of Networking:

1. Demonstrate the ability to solve basic problems and perform basic troubleshooting operations on LANs and connected devices. [Usage]
2. Describe and explain why different technologies are deployed in different contexts of networking, such as topology, bandwidth, distance, and number of users. [Familiarity]

Operating Systems:

1. Describe the advantages and issues associated with virtualization. [Assessment]

2. Explain the value of fault tolerance for disaster recovery. [Usage]

Administrative Activities:

1. Describe the need for managing IT resources. [Assessment]
2. Identify situations in which administrative activities are required. [Assessment]

Administrative Domains:

1. Describe the responsibilities common to the various administrative domains. [Assessment]
2. Describe the responsibilities unique to each of the various administrative domains. [Assessment]
3. Identify responsibilities in each domain that support activities in other domains. [Familiarity]

Organizational Context:

1. Outline the basic parts of a typical IT environment. [Familiarity]

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Course Outcomes Emphasized in Laboratory Projects / Assignments

	Outcome	Number of Weeks
1	Complete vendor-provided labs Outcomes: 2,3,4,5,6	10
2	Graded quizzes on each section	12
3	Group project to deploy cloud solution	3
4	Multiple certification exam preparation practice tests near semester end – certification attainment part of grade	4

Oral and Written Communication: Group project presentation

Social and Ethical Implications of Computing Topics: No significant coverage

Theoretical Contents

1.	Network architecture and network design
2.	Authentication/authorization methods
3.	Server virtualization
4.	Cloud concepts (service models, deployment models, security, automation, business justification)
5.	Storage and database models

Problem Analysis Experiences

1.	Identify potential issues with cloud deployments
2.	Optimize cloud architectures to meet business needs

Solution Design Experiences

1.	Build cloud infrastructure
2.	Deploy applications on cloud infrastructure

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The Coverage of Essential & Supplementary IT Domains[1]

Knowledge Unit	Topic	Lecture Hours
ITS-VSS-04	Server Virtualization	3
ITS-VSS-05	Network Virtualization	4
ITS-VSS-08	Storage Virtualization	4
ITS-CCO-01	Cloud computing perspectives & impact	2
ITS-CCO-02	Cloud computing concepts and fundamentals	2
ITS-CCO-03	Cloud computing Security and data considerations	6
ITS-CCO-04	Using cloud computing applications	3
ITS-CCO-05	Cloud computing architecture	7
ITS-CCO-06	Development in the cloud	4
ITS-CCO-07	Cloud computing infrastructure and data	5

[1]See *Information Technology 2017 - Curriculum Guidelines for Baccalaureate Degree Programs in Information Technology;* by Association for Computing Machinery (ACM), IEEE Computer Society; cf. Essential & Supplementary IT Domains, pages 51 & 52. Available at: https://www.acm.org/binaries/content/assets/education/curricula-recommendations/it2017.pdf

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Potential Grading Format

- **Completion of AWS Cloud Solutions Architecture course (20%)** – This would only be a completion %, not grading the assignments, however, labs must be completed successfully. This is viewable through Canvas.
- **Quizzes on each major section (8 of them) (30%)** – These could be open book on Canvas and then reviewed in class to reinforce the lectures.
- **Group project to deploy multi-layered application in a cloud environment (20%)** – Can use AWS Academy Lab environment.
- **Certification Exam (30% - 100 points)** – These could be graded as follows:
    - 50 points for registering and taking the certification exam.
    - 0-50 on a sliding scale depending on certification exam score.
        - 720+ Certification achieved – 50 points.
        - 700-719 – 40 points
        - 670-699 – 30 points
        - 620-669 – 20 points
        - 570-619 – 10 points
        - Below 570 – 0 points
- No Final Exam

Grading Scale

Letter	Range%	Letter	Range%	Letter	Range%
A	95 or above	B	83 - 86	C	70 - 76
A-	90 - 94	B-	80 - 82	D	60 - 69
B+	87 - 89	C+	77 - 79	F	59 or less