

# CS - 721 - Real-Time and Embedded Systems

2 Graduate Course Create 2021-22

## I. Course Information

The faculty member originating this proposal is to complete sections I,II, III, and IV.

TURN ON help text before starting this proposal by clicking  in the top right corner of the heading.

You will need to turn on help text again after any actions that refresh the page including after saving proposals, importing information, or running impact reports.

FILL IN ONLY fields required marked with an \*. You will not be able to launch the proposal without completing the required fields.

Department\*

Computer Science

Prefix:\*

CS

Number:\* 721

Is a new Prefix being suggested?  Yes  No

Suggested Prefix

Long Course Name:\* Real-Time and Embedded Systems

Short Course Name\* Real-Time and Emb. Sys.

Tip: 25 characters max. for short name (abbreviations are acceptable if needed)

### Tips

avoid the use of the words *student*, *course*, and *covers*  
incomplete sentences are ok  
avoid repeating the course title  
(50 words max)

**Catalog Description\***

Operating system design for real-time and embedded systems. Focus on scheduling, synchronization, communication, and process and memory management for time-critical and resource-constrained applications.

**Is this course a culminating experience?\***

Yes  No

**If Yes, to which programs?****First Term Course Offered\***

Fall 2021

**Explanation for Course Create\***

Real-Time systems offer temporal guarantees for system execution, i.e., the system guarantees the generation of a desired output within a specific time limit. Many applications, such as autonomous driving, avionics, medical devices, robotics, and industrial process control, use real-time systems to meet government requirements or ensure safety.

This course intends to introduce the design of such systems focusing on scheduling, synchronization, communication, and process and memory management. It also aims to introduce the timing analysis of such systems. This course will be the first course focusing on the design and analysis of systems requiring temporal guarantees.

**Are you adding a Service-Learning designation to this course?\***

Yes  No

If the Service-Learning designation is being added to this course:

A syllabus in Word or PDF format must accompany this form.

Graduate syllabi must meet the minimum criteria as required by the Provost's office (See Semester Memo under Executive Vice President and Provost Policies and Forms [www.unlv.edu/policies](http://www.unlv.edu/policies)). Graduate courses that are linked to undergraduate courses (300/500 and 400/600 level joint courses) must clearly state in the syllabus how the class experience and expectations are different for graduate students, what additional requirements students enrolled in the graduate level course must fulfill, and how the grading scale will be applied to graduate students.

Please attach a current syllabus by navigating to the Proposal Toolbox and clicking  in the top right corner.

Information about Service-Learning is available [here](#). Faculty can visit the [faculty Service-Learning page](#) as well as the [UNLV Guide for Service Learning](#) for additional information.

**If adding Service-Learning designation, syllabus is attached**

Attached

## II. Catalog Information

Will this be an experimental (x) course?  Yes  No

Has this course number been used previously as an Experimental (X) course?  Yes  No

If yes, X-Course Prefix

X-Course Code

Program(s) impacted by this new course\* Ph.D. and M.S. in Computer Science

**Tip (note): A Program Change form will need to be submitted to add the new course into a program.**

Detail the changes to the program catalog entry required due to the creation of this course.\*

This course is designed to expand the growing M.S. and (mostly) Ph.D. program in Computer Science by introducing students to research in real-time systems with a focus on analyzing and verifying the timing guarantees of applications on a specific platform. This analysis methods can be applied to a broad range of latency-sensitive and real-time applications in computer science. Furthermore, the course enables students to identify and critique major contributions in real-time systems research, allowing students to extend their current research for latency-sensitive or real-time applications.

Fixed/Variable Credits\*  Fixed  Variable

If fixed, enter number of credits. If variable, enter minimum and maximum credits (E.g., 1-3)

Number of Credits 3

Course is Repeatable\*  Yes  No

If yes, the maximum number of credits that may be earned is

Grading System\*  Letter Grade  S/U  Thesis/Dissertation

Is this a Special Topics course?  Yes  No

Sub-topic(s)

Are topics repeatable?  Yes  No

If yes, number of credits

Prerequisites CS 677 Analysis of Algorithms

Corequisites

Does this course have any non-credit components?  Yes  No

- If yes, indicate component(s)
- Clinical
  - Discussion
  - Field Studies
  - Independent Study
  - Internship
  - Laboratory
  - Lecture
  - Practicum
  - Research
  - Seminar
  - Supervision
  - Thesis Research

- CROSS-LISTING / Same As, will this course be:\***
- Same As=Undergraduate: same content and same career (UG/UG). Graduate: Same/similar course content and same career (Grad/Grad)
  - Cross-listing= Cross-listed courses contain the same or similar content and may be in different programs (eg., WMST 497 & SOC 497) or different careers (e.g., BIOL 467 & BIOL 667 or PSC 722 & PHIL 728)
  - Not Cross-Listed or Same As

If yes, list the course

If yes, please include below the rationale for crosslisting, answering to the following questions:

- 1) What aspect of graduate preparation is met via this course that goes beyond the undergraduate program?
- 2) What common aspects are offered in the crosslistings and what grad level pieces are not?
- 3) What would be beneficial in offering the crosslisted courses from a graduate education perspective?

Crosslisting Rationale:

**Indicate the instructional modes that should be available for scheduling\***

- In Person Supplemental Web
- Field Study
- Hybrid
- Independent Study
- Television
- Web-based
- Web-based w/ on/off campus meeting

**Differential fees required for this course? (if yes, please clarify on explanation field above)**

- Yes  No

### III. Evaluation of Library Resources

**A. This section is completed by the faculty member originating this proposal—indicate library resources that will be needed to support this course**

**Will this course creation require changes to library resources?\***

- Yes  No

**Please indicate library resources that will be needed to support students taking this course\***

- Core journals
- Core books (not required texts)
- Electronic resources (e.g., databases, videos, media, etc.)


**Critically needed journals for this subject area:**

**Core books needed:** High-Embedded Computing: Architectures, Applications, and Methodologies. Wayne Wolf, Morgan-Kaufman, 2007

**Electronic Resources:**

3. LAUNCH proposal by clicking  in the top left corner.

4. Finish the launch of your proposal by clicking the icon  located in the Proposal Toolbox on left side at top. Make your decision, comment is optional, and click on "Make decision".

You can check the status of the proposal by clicking  in Proposal Toolbox to verify that the proposal has gone to the next step.

B. This section is completed by the librarian.

Level of support the  
Library can provide

Library Comments

## IV. Syllabus

A syllabus in Word or PDF format must accompany this form.

Graduate syllabi must meet the minimum criteria as required by the Provost's office (See Semester Memo under Executive Vice President and Provost Policies and Forms <https://www.unlv.edu/policies/current-policies>). Graduate courses that are linked to undergraduate courses (300/500 and 400/600 level joint courses) must clearly state in the syllabus how the class experience and expectations are different for graduate students, what additional requirements students enrolled in the graduate level course must fulfill, and how the grading scale will be applied to graduate students.

## Attachments List


Please attach any required files by navigating to the Proposal Toolbox and clicking  in the top right corner.

Attached syllabus\*  Attached

## V. Department Vote Information

Note: This section is to be filled out by the Department Chair on behalf of the committee.

(The role has been assigned to the corresponding person on this step. If incorrect, please notify GradCurriculum@unlv.edu)

1. Review the proposal. Discuss and make appropriate revisions.
2. Fill in vote information.
3. Then go to the proposal toolbox at the top right side. Click on  and select the corresponding decision for the committee. This will enable the proposal to go to the next person on the workflow.

You can check the status of the proposal by clicking  in Proposal Toolbox to verify that the proposal has gone to the next step.

Date faculty voted  
on proposal 3/31/2021


**Result of vote** 10-0-4  
(Number of  
yes/no/abstention  
votes)

**Manner of vote** online  
(online, in-person,  
etc.)

## VI. Unit Vote Information

**Note:** This section is to be filled out by the College Committee Chair on behalf of the committee.

(The role has been assigned to the corresponding person on this step. If incorrect, please notify GradCurriculum@unlv.edu)

1. Review the proposal. Discuss and make appropriate revisions.
2. Fill in vote information.
3. Then go to the proposal toolbox at the top right side. Click on  and select the corresponding decision for the committee. This will enable the proposal to go to the next person on the workflow.

You can check the status of the proposal by clicking  in Proposal Toolbox to verify that the proposal has gone to the next step.

**Date faculty voted** 3/24/2021  
**on proposal**

**Result of vote** 4/0/0  
(Number of  
yes/no/abstention  
votes)

**Manner of vote** online  
(online, in-person,  
etc.)

## VIII. Processing Notes (Graduate College/Registrar Use Only)

**PS Processing Notes**

**PS Processing Date**

**Initials**

**Aalog Processing  
Notes**

**Aalog Processing  
Date**

**Initials**



## Comments for CS - 721 - Real-Time and Embedded Systems

|  |  |
|--|--|
| <b>Curriculog</b>  | 4/22/2021 10:34 am <a href="#">Reply</a> |
| Emily Lin has approved this proposal on Graduate College Dean.   |  |
| <b>Curriculog</b>  | 4/21/2021 10:31 am <a href="#">Reply</a> |
| James Navalta has approved this proposal on behalf of Graduate Course Review Committee. See <a href="#">Graduate Course Review Committee 4-14-2021</a> for more information. |  |
| <b>Curriculog</b>  | 4/20/2021 9:21 am <a href="#">Reply</a>  |
| Graduate Curriculum has approved this proposal on Graduate Course Review Committee.  |  |
| <b>Curriculog</b>  | 3/24/2021 4:25 pm <a href="#">Reply</a>  |
| Mohamed Trabia has approved this proposal on School/College Associate Dean/ Dean.  |  |
| <b>Melissa Morris</b>  | 3/24/2021 3:09 pm <a href="#">Reply</a>  |
| The college committee unanimously approves this proposal.  |  |
| <b>Curriculog</b>  | 3/24/2021 3:09 pm <a href="#">Reply</a>  |
| Melissa Morris has approved this proposal on School/College Committee.   |  |
| <b>Curriculog</b>  | 3/23/2021 3:55 pm <a href="#">Reply</a>  |
| CS Chair has approved this proposal on Department Chair.   |  |
| <b>Curriculog</b>  | 3/23/2021 3:24 pm <a href="#">Reply</a>  |
| Computer Science Graduate Coordinator has approved this proposal on Graduate Coordinator.  |  |
| <b>Curriculog</b>  | 3/8/2021 0:14 am <a href="#">Reply</a>   |
| This proposal has passed its deadline and has been approved.   |  |
| <b>Curriculog</b>  | 3/4/2021 11:26 am <a href="#">Reply</a>  |
| Graduate Curriculum has approved this proposal on Technical Review.  |  |

**Curriculog**

3/2/2021 2:13 pm [Reply](#)

**Venkata Prashant Modekurthy has approved this proposal on Originator.**

**Curriculog**

1/6/2021 9:05 pm [Reply](#)

**Venkata Prashant Modekurthy has launched this proposal.**