

# SPST415

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## Course Summary

**Course :** SPST415 **Title :** Space Station Systems and Operations

**Length of Course :** 8

**Prerequisites :** SPST200, SPST300 **Credit Hours :** 3

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## Description

**Course Description:** This course elaborates on Space Station flight operations, its supporting elements and planned systems. Students will study commercial applications, logistical support, maintenance and servicing design concepts. (Prerequisite: SPST200 or SPST300)

### Course Scope:

The purpose and scope of this course is to examine the history and purpose of space stations and provide the student with the analytical tools to identify and explain the requirements to operate and maintain the International Space Station (ISS). It provides the student with the knowledge to identify and discuss the current and future uses of the ISS and the elements that provide its operational support.

The first half of this course covers the history of space stations beginning with the first designs and accomplishments from both the U.S. and Soviet Union. The history follows the successes and failures of both U.S. and Soviet Union space station operations to the cooperative Mir space station endeavor and beyond. SPST415 provides the student with the intellectual foundation to identify and explain the lessons learned from these early programs and how this information is being used to construct and operate the International Space Station. In addition, this course also covers the commercial applications, logistical support, maintenance and servicing design concepts, and international cooperation involved with the ISS.

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## Objectives

Upon completion of this course, the student will be able to:

- CO-1** Examine the early history of space station design from both the U.S. and Soviet perspective.
- CO-2** Describe the trials, tribulations, accomplishments, and lessons learned associated with Skylab, Salyut, and Mir space programs.
- CO-3** Examine NASA's post-Apollo strategy and President Reagan's initiative to establish the U.S.'s leadership role in space.

**CO-4** Describe the evolution of Mir and recall the various accomplishments of this permanently inhabited research space station.

**CO-5** Describe the international efforts and struggling beginning of the ISS.

**CO-6** Describe the purpose and objective of each ISS element/module.

**CO-7** Describe and identify the function of various systems, subsystems, and architectures.

**CO-8** Describe the ISS operational maintenance philosophy.

**CO-9** Describe the four planning phases of the increment planning process and the associated activities and products.

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## Outline

### Week 1: Apollo, Chelomei, and Skylab; NASA, Salyut, and Reagan's Order

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#### Learning Objectives

**LO-1** Examine the early history of space station design from both the U.S. and Soviet perspective.

**LO-2** Recall the trials, tribulations, and accomplishments associated with the Skylab program.

**LO-3** Examine NASA's post-Apollo strategy and President Reagan's initiative to establish the U.S.'s leadership role in space.

**LO-4** Examine the early struggles and ultimate successes of the Salyut program (including the Almaz program).

#### Readings

Catchpole, Chapters 1-2

Online: [Skylab Program Overview](#)

[Skylab, Our First Space Station](#)

Online: [Russia's Early Space Stations](#)

#### Assignments

**Week 1 (Virtual Introductions) Forum**

**Quiz #1**

**Worksheet #1 (Skylab Program)**

### Week 2: Salyut 7 and Space Station Freedom; Mir

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#### Learning Objectives

**LO-5** Describe the evolution of Space Station Freedom.

**LO-6** Describe the evolution of Mir and recall the various accomplishments of this permanently inhabited research space station.

## Readings

Catchpole, Chapters 3-4

Online: [Space Station Freedom Chronology](#)

Online: [Mir Space Station](#)

Week 2 Lesson Module

## Assignments

Quiz #2

Week 2 Forum

## Week 3: International Space Station/ Shuttle-Mir; Building Hardware

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### Learning Objectives

**LO-7** Describe the international cooperation involved with Mir and recognize how these efforts foreshadowed the international aspect of the ISS.

**LO-8** Describe the international efforts and early construction of the ISS.

### Readings

Catchpole, Chapters 5-6

Online: [History of Shuttle-Mir](#)

Week 3 Lesson Module

ISS Construction.pdf Document (ISS Documents Folder in the Resources section)

## Assignments

Quiz #3

Week 3 Forum

## Week 4: Orbital Assembly and Introduction to ISS Systems; ISS Command and Data Handling, and Electrical Power Systems

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### Learning Objectives

**LO-9** Recall the multiple missions required for the orbital assembly of the ISS and review its current configuration.

**LO-10** Describe the purpose and objective of each ISS element/module.

**LO-11** Explain the composition and purpose of the Command and Data Handling system.

**LO-12** Describe how the EPS architecture provides for power generation, storage, distribution, conversion, and supporting functions.

### Readings

ISS Fam Manual, Section 1 (ISS Documents Folder)

Online: [ISS Interactive Reference Guide](#)

[ISS Configuration](#)

ISS Fam Manual, Sections 2 - 3

Online: [ISS Reference Guide \(How the Crew Lives\)](#) (pgs 81-96)

Week 4 Lesson Module

Assignments

[Quiz #4](#)

[Week 4 Forum](#)

## **Week 5: ISS Communication and Tracking System; ISS Thermal Control, Environmental Control and Life Support Systems**

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Learning Objectives

**LO-13** Describe the major functions, operations, capabilities, constraints, and redundancies of the C&T capabilities.

**LO-14** Identify the functions of each of the TCS subsystems.

**LO-15** Describe the major functions provided by ECLSS and each of its subsystems.

Readings

ISS Fam Manual, Section 4

ISS Fam Manual, Sections 5 – 6

Week 5 Lesson Module

Assignments

[Worksheet #2 \(Crew rotation and GR&C document\)](#)

[Week 5 Forum](#)

## **Week 6: ISS Guidance, Navigation, Control and Robotics Systems; ISS Structures and Mechanisms and Payloads**

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Learning Objectives

**LO-16** Describe the six GNC functions and summarize the interfaces between U.S. GNC and the other ISS systems.

**LO-17** Describe the characteristics of each of the three ISS Robotics Systems, including the operator control method and large/small arm capability.

**LO-18** Identify and describe the various elements, truss segments, and mechanisms that make up the ISS.

**LO-19** Identify the important payload components and the research disciplines planned for the ISS.

Readings

ISS Fam Manual, Sections 7 – 8

Week 6 Lesson Module

ISS Fam Manual, Sections 9 - 10

Online: [ISS Laboratories](#)

Assignments

Quiz #5

Week 6 Forum

## **Week 7: ISS Extravehicular Activity and On-Orbit Maintenance; ISS Flight Crew Systems**

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Learning Objectives

**LO-20** Describe the major differences between the EMU and the Orlan spacesuits and identify the two major types of EVAs required for assembly of the ISS.

**LO-21** Describe the ISS operational maintenance philosophy.

**LO-22** Identify and describe the purpose of FCS Subsystems and hardware.

Readings

ISS Fam Manual, Sections 11 - 12

ISS Fam Manual, Section 13

Assignments

Research Paper Due

Weeks 7 Forum

Take Final Exam (Available at the end of Week 7 - Due by the end of Week 8)

## **Week 8: ISS Crew Health Care Systems; ISS Operations and Planning**

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Learning Objectives

**LO-23** Identify the purpose of the CHeCS, its subsystems, and its key components.

**LO-24** Describe the four planning phases of the increment planning process and the associated activities and products.

Readings

ISS Fam Manual, Section 14

ISS Fam Manual, Section 15

Assignments

Submit Final Exam

Week 8 Forum –

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# Evaluation

## Forums/Class Participation

There will be a new forum every one to two weeks throughout the course. Your knowledge of the assigned readings will be reflected in your ability to actively participate and discuss key course concepts. Your initial posting should be between 200-400 words in length (not including citations), well written in your own words (unless otherwise noted) and grammatically correct. There is no required length for your response to your fellow students. However, your response needs to have substance; simply saying “good point” and/or “I agree” isn’t adequate.

In the forums, you will be required to post your response to the topic being discussed. *With the exception of the Virtual Introductions forum, you will also be required to reply to at least one of your fellow students and ask that student a question about what he/she has written. If you are asked questions, I expect you to answer at least one of the questions.* **You will not receive full credit for the forum assignments unless you fully follow these instructions. In other words, you will not receive full credit unless you complete your initial post, ask a question to at least one student and answer at least one question that you are asked. Additionally, if you make your initial post late on Sunday (thereby not giving your fellow students an opportunity to ask you a question), you can expect that I will ask you a question, which you must answer to receive credit for this part of the forum.**

Your forum postings will be graded both for content (75%) and writing standards (correct grammar, spelling, punctuation, etc.) (25%). With the exception of the Week 1 (Introductions) forum, I will use a 100-point scale for grading and the breakdown of possible points is listed below:

- Initial posting: worth a maximum of 60 points
- Response/reply to your fellow students: worth a maximum of 20 points
- Answer to a fellow student: worth a maximum of 20 points

All of your postings must be completed by the forum’s due date, unless you make a previous arrangement with me for a new due date for the forum. **Specifically, for the Week 2-8 forums, your initial postings are due no later than Wednesday (11:59:59 p.m. Eastern time zone) of the week in which the forum is due.** You can then use the remaining days to post your replies to your fellow students and answer their questions.

The purpose of the forums is for you to engage your fellow students and learn from them. For this to occur, your interactions in the forums need to be timely. Therefore, I will deduct a maximum of 10 points for late posts from your overall score for a forum. Additionally, postings more than one week after the due date for a forum will NOT be accepted (with the exception of approved course extensions).

## Quizzes

Quizzes 1-5 are not comprehensive and only cover the assigned reading/objectives between the previous quiz and that quiz. No proctors are required for the quizzes. **Although open book, it is virtually impossible to pass the quizzes without first completing all of the assigned reading and looking through the assigned websites.** The format for each quiz is a combination of multiple-choice, matching, true/false, fill-in-the-blank and short answer/essay questions. For each short answer/essay question, 75% of your grade will be based on your answer’s content and 25% on writing standards (correct grammar, spelling, punctuation, etc.). **The quizzes are 75 minutes in length.** Once completed, no interaction between students regarding quiz topics is allowed!

## Worksheets

You will complete two worksheets during the course. The first worksheet covers the Skylab program and the second worksheet covers a high-level ISS program document and the current crew rotation strategy. The worksheets are designed to help guide you through the subject material and to help you focus on the more

relevant information. The Skylab program worksheet is due at the end of Week 1 and covers the material in the two Skylab program websites listed in the Course Outline for Week 1. The second worksheet is due at the end of Week 5 and covers the ISS program document found in the Week 5 Lesson Module. **The worksheets can be found in the Test & Quizzes area of the class.**

## **Final Exam**

**The final exam covers the entire course and is two hours long.** No proctor is required.

## **Research Paper**

For your research paper, you have an option concerning the topic of the paper. You may choose on your own a topic related to space stations, such as past space station designs (Salyut, Mir, Skylab) or a proposal for a future space station design. You could focus on a particular system used on a space station or you could address a broader issue such as the militarization of space stations. These are just a few examples.

Your other option is to write a paper about how the ISS should be used to support human exploration beyond low Earth orbit. Based on recommendations in the Augustine Committee report, President Obama, in conjunction with NASA and the other international partners, has decided to extend operation of the ISS until 2020 (and possibly longer). In your paper, you would discuss how the ISS could be used to prepare and/or support human spaceflights to possible destinations such as the moon, an asteroid or Mars. What sort of technology could be tested onboard ISS and what type of research could be conducted to better prepare for these missions beyond low Earth orbit? Additionally, you could discuss whether or not the current mission profile on the ISS (six-month stays) should be modified to support the future missions outlined in the “Flexible Path” concept proposed by the Augustine Committee (a copy of their report is in the Reference Materials folder in the Resources area of the class). **You may choose your topic. However you must present the topic to me for approval, and you should decide on your topic by the end of week 2.**

Requirements for your paper are listed below:

- **Length:** 10-12 pages (for the body of the paper), not including title page, and pages for citations (endnote format) and your list of references used.
- **Number of References:** at least seven (peer-reviewed journals, books, articles, websites, etc.).
- **Citation Style:** Turabian – you may use footnotes, endnotes or parenthetical (in-text) citations. The choice is yours.

**Your paper is due by the end of Week 7 (by 11:59:59 p.m. (Eastern time zone) on Sunday).**

## **Due Dates**

All assignments in this course are given to you prior to the due date. The “due date” for all assignments is the week in which the assignment is due. For the purposes of this course, a **“week”** is defined as the time period between Monday – Sunday. The **first week** begins on the first day of the session and ends on 11:59:59 p.m. (Eastern time zone) the following **Sunday**. As a general rule, I will grade an assignment once everyone has submitted it. ***If you need additional time to complete an assignment, please contact me before the due date so we can discuss the situation and determine an acceptable resolution.*** **If you submit an assignment after the due date without making prior arrangements with me, you will lose points from your final grade for the assignment.**

## **Maintaining Contact**

During this course, we can maintain contact in several ways. **The first and best way is to send me a message using the classroom message system;** the next way is via e-mail; and the last way is by phone. Please don't get me wrong – I don't mind phone calls. But since we are all on different schedules, I ask that you send me a message first to arrange a time to talk. However, most questions are best answered in writing. That way, the information can be referred to again in the future. **And questions about the course are best discussed in the classroom, so I ask that you send me a message in the classroom to do this.**

## Grading:

Name	Grade %
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## Materials

**Book Title:** The International Space Station: Building for the Future-e-book available in the APUS Online Library

**Author:** Catchpole, John

**Publication Info:** Praxis

**ISBN:** 9780387781440

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**Book Title:** To find the library e-book(s) req'd for your course, please visit <http://apus.libguides.com/er.php> to locate the eReserve by course #. You must be logged in to eCampus first to access the links.

**Author:** N/A

**Publication Info:** N/A

**ISBN:** N/A

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**Book Title:** Reference Guide to the International Space Station-Available free online

**Author:** Kitmacher, Gary

**Publication Info:** NASA

**ISBN:** SPST415-NTMO

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## Course Guidelines

### Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

### Tutoring

- [Tutor.com](http://Tutor.com) offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours\* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

### Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under



each Assignment.

- Generally speaking, late work may result in a deduction up to 15% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

## **Turn It In**

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

## **Academic Dishonesty**

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not copy/paste, and always cite.

## **Submission Guidelines**

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

## **Disclaimer Statement**

- Course content may vary from the outline to meet the needs of this particular group.

## **Communicating on the Forum**

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- “Substantive” means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says “I agree” is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

## **Identity Verification & Live Proctoring**

- Faculty may require students to provide proof of identity when submitting assignments or completing assessments in this course. Verification may be in the form of a photograph and/or video of the student's face together with a valid photo ID, depending on the assignment format.
- Faculty may require live proctoring when completing assessments in this course. Proctoring may include identity verification and continuous monitoring of the student by webcam and microphone during testing.

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# University Policies

## [Student Handbook](#)

- [Drop/Withdrawal policy](#)
- [Extension Requests](#)
- [Academic Probation](#)
- [Appeals](#)
- [Disability Accommodations](#)

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