COURSE OUTLINE : AT 153
D Credit – Degree Applicable
COURSE ID 010240
Cyclical Review: September 2020

COURSE DISCIPLINE : AT

COURSE NUMBER : 153

COURSE TITLE (FULL) : Introduction to Unmanned Aerial Systems

COURSE TITLE (SHORT) : Intr to Unmanned Ariel Systems

CATALOG DESCRIPTION

AT 153 is an introductory course to understanding the functions, characteristics, regulations, and applications of unmanned aerial systems and vehicles. The course includes a detailed discussion of unmanned aerial systems and their uses in military, commercial, civil, and public settings.

CATALOG NOTES

The student must be able to speak, read and understand the English language per the requirements of Part 61 of the Federal Aviation Regulations as explained in FAA Advisory Circular 60-28B, and the Level 4 requirements of the International Civil Aviation Organization.

Total Lecture Units: 3.00

Total Laboratory Units: 0.00

Total Course Units: 3.00

Total Lecture Hours: 54.00

Total Laboratory Hours: 0.00

Total Laboratory Hours To Be Arranged: 0.00

Total Contact Hours: 54.00

Total Out-of-Class Hours: 108.00

Recommended Preparation: AT 152 and ENGL 100 or ESL 141, or equivalent.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1	AT	152	Introduction to Unmanned Aerial Vehicles	Identify, examine, and assess the uses of unmanned aerial vehicles (UAV) in military, commercial, civil, and public settings;	Yes
2	AT	152	Introduction to Unmanned Aerial Vehicles	analyze, discuss, and differentiate manned versus unmanned aircraft missions;	Yes
3	AT	152	Introduction to Unmanned Aerial Vehicles	describe components of UAS sensor and communication systems;	Yes
4	AT	152	Introduction to Unmanned Aerial Vehicles	define and design unmanned aerial vehicle (UAV) with airworthiness to accommodate a UAS mission.	Yes
5				analyze short essays (at least five paragraphs in length) to identify thesis, topic development and concluding sentences, as well as traditional expressions used to increase coherence;	Yes
6				evaluate compositions for unity, and sufficiency of development, and coherence, as well as variety of sentence structure;	Yes
7				organize and write a thesis-driven, organized essay which is at least three paragraphs in length (paragraphs should have a topic sentence and at least five additional sentences which further develop that topic sentence with explanations or examples. These sentences must be in logical order and be connected by transitional expressions, where appropriate. Paragraphs must be tied together by appropriate transitions or other devices which provide cohesion.);	Yes
8				use in their essays a variety of sentence types with minimal errors in such basics of the sentence as subject-verb agreement, subordination, and complementation;	Yes

9				identify, examine, and assess the uses of unmanned aerial vehicles (UAV) in military, commercial, civil, and public settings;	Yes
10				analyze, discuss, and differentiate manned versus unmanned aircraft missions	Yes
11	ENGL	100	Writing Workshop	Read, analyze, and evaluate contemporary articles and stories to identify topic, thesis, support, transitions, conclusion, audience, and tone;	Yes
12	ENGL	100	Writing Workshop	read, analyze, and evaluate contemporary articles and stories for the comprehension of difficult content and the identification of main ideas and (topic-based) evidence;	Yes
13	ENGL	100	Writing Workshop	read, analyze, and evaluate student compositions for unity, development, use of evidence, interpretation, coherence, and variety of sentence form;	Yes
14	ENGL	100	Writing Workshop	write a summary of a contemporary article or story with correct citation techniques;	Yes
15	ENGL	100	Writing Workshop	write an argumentative essay that has an introduction, body paragraphs, and a conclusion, demonstrating a basic understanding of essay organization;	Yes
16	ENGL	100	Writing Workshop	write an argumentative essay that addresses the topic, is directed by a thesis statement, uses appropriate textual evidence, develops logical interpretations, and concludes with some compelling observations;	Yes
17	ENGL	100	Writing Workshop	write an argumentative essay that integrates the ideas of others (i.e., authors) through paraphrasing, summarizing, and quoting with correct citation techniques;	Yes
18	ENGL	100	Writing Workshop	write an argumentative essay that generates novel ideas (those that add to the conversation rather than repeating the author's ideas) related to the topic and the readings;	Yes
19	ENGL	100	Writing Workshop	write compositions (e.g., summaries and argumentative essays) that are easy to read and follow, though some errors in grammar, mechanics, spelling, or diction may exist;	Yes
20	ENGL	100	Writing Workshop	proofread and edit essays for content, language, citation, and formatting problems.	Yes

21	ESL	141	Grammar and Writing IV	Compose a 400 to 450-word thesis-based essay which: (a) summarizes and cites appropriately a reading passage provided as a prompt, (b) includes a clear thesis statement, (c) uses evidence to support the thesis, (d) shows clear organization into an introduction, body, and conclusion, and (e) uses appropriate rhetorical modes such as comparison/contrast, cause/effect, and persuasion in order to support a thesis.	Yes

EXIT STANDARDS

1 Identify, examine, and assess the uses of unmanned aerial systems (UAS) in military, commercial, civil, and public settings;
2 analyze, discuss, and differentiate manned versus unmanned aircraft missions;
3 describe components of UAS sensor and communication systems;
4 define and design UAV with airworthiness to accommodate a UAS mission.
5 define, describe, and identify components of UAS sensors and communication mechanisms.

STUDENT LEARNING OUTCOMES

1 describe and apply fundamental airworthiness concepts necessary for specific UAS missions;
2 identify military, civil, commercial, and public uses of UAS;
3 compare manned and unmanned aircraft missions.

COURSE CONTENT WITH INSTRUCTIONAL HOURS

	Description	Lecture	Lab	Total Hours
1	UAS Basics • Definitions and attributes • Manned vs unmanned • Design considerations and architecture • Life cycle costs • Components • Air vehicle • Payload • Communications, data link, and ground control station	6	0	6

2	UAS Types and Civilian Roles • Categories, uses, and classifications • Public and civil UAVo UK and international classifications • Law enforcement • Disaster relief • Fire detection & assessment, • Customs & border patrol • Nuclear inspection	4	0	4
3	Alternative Power • Solar and fuel cells • The need for alternative propulsion for UAS • Alternative power trends & forecast • Solar cells & solar energy • Solar aircraft challenges • Solar wing design • Past solar designs • Energy storage methods and density • Fuel cell basics and UAS integration • Fuel cells used in current small UAS • Hybrid power	2	0	2
4	Communications & Data Links • Current state of data links • Future data link needs • Line of sight fundamentals and beyond • UAS communications failure • Link enhancements • STANAG 4586 • Multi UAS control	7	0	7
5	UAS Conceptual Design • UAS design process • Airframe design considerations • Launch & recovery methods • Propulsion, control and stability • Ground control system • Support equipment • Transportation	7	0	7
6	Human Machine Interface • Human factors engineering explained human machine interface • Computer trends • Voice recognition and control haptic feedback • Spatial Audio (3D Audio) • AFRL MIIRO • Synthetic Vision Brain Computer Interface (CRM)	4	0	4

7	Sense and Avoid Systems • Sense and avoid function • Needs for sense and avoid • TCAS • TCAS on UAS • ADS-B • Non cooperative fov & detection requirements • Optical, acoustic, and microwave sensors	4	0	4
8	UAS Civil Airspace Issues • Current State • UAS Worldwide Demand • UAS Regulation & airspace problems • Existing Federal UAS regulation equivalent level of safety • Airspace categories • Collision avoidance & sense and avoid • Recommendations	6	0	6
9	Civil Airspace Integration Efforts • Civil UAS News • FAA Civil UAS Roadmap • UAS Certificate of Authorization Process • UAPO Interim Operational Approval Guidance (8-01) • 14 CFR 107 Rule • NASA UAS R&D Plano NASA Study Results • RTCA SC 203 • UAS R&D Plan • FAA Reauthorization Bill • Six Test Sites	2	0	2
10	UAS Navigation • Satellite, inertial, and sensor fusion navigation • Image Navigation (Skysys) • Locatta • Satellite/INS/Video • Image Aided INS (NAVSYS)	4	0	4
11	Autonomous Control • Vision • Definitions • Automatic control • Automatic air to air refueling • Autonomy • Advanced AI applications • Intelligent control techniques	4	0	4

12	UAS Swarming • History of swarming • Modern military swarming • Swarming battles, characteristics, concepts • Emergent behavior • Swarming algorithms • Swarm communications	2	0	2
13	Future UAS Capabilities • Space UAS & Global Strike • Advanced hypersonic weapon • Submarine Launched UAS • UCAS • Pseudo-satellites • Future military missions & technologies	2	0	2
				54

OUT OF CLASS ASSIGNMENTS

1 reading notes;
2 current event homework;
3 UAS design group project (e.g. write a field report based on observations of a specific system).

METHODS OF EVALUATION

1 essay examinations;
2 midterm examination;
3 final exam.

METHODS OF INSTRUCTION

- [ ] Lecture
- [ ] Laboratory
- [ ] Studio
- [x] Discussion
- [x] Multimedia
- [x] Tutorial
- [ ] Independent Study
- [x] Collaboratory Learning
- [x] Demonstration
- [x] Field Activities (Trips)

☑ Guest Speakers

☑ Presentations

TEXTBOOKS

Title	Type	Publisher	Edition	Medium	Author	IBSN	Date
Theory, Design, and Applications of Unmanned Aerial Vehicles	Required	CRC Press	2	Print	Jha, A. R.	9780367574239	2020
Theory, Design, and Applications of Unmanned Aerial Vehicles	Supplemental	CRC Press	2	digital	Jha, A. R.	9781315371191	2020