

PALOMAR COLLEGE
COURSE OUTLINE OF RECORD FOR
DEGREE CREDIT COURSE

XX Transfer Course XX A.A. Degree applicable course
(check all that apply)

COURSE NUMBER AND TITLE: AERONAUTICAL SCIENCES 205 Principles of Aerodynamics

UNIT VALUE: 3

MINIMUM NUMBER OF SEMESTER HOURS: 48

BASIC SKILLS REQUIREMENTS: Appropriate language skills.

ENTRANCE REQUIREMENTS

PREREQUISITE: None

COREQUISITE: None

RECOMMENDED PREPARATION: None

SCOPE OF COURSE:

Introduction to the theory of flight; applications of the basic laws of physics to the principles of flight. Aircraft design is considered with respect to airfoils, wings, viscous effects, propellers, and aircraft performance.

SPECIFIC COURSE OBJECTIVES:

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

1. explain the forces which act upon an aircraft in flight.
2. describe stability and control of an aircraft.
3. explain the principles of operation of turbine engines.
4. identify and describe problems dealing with high speed flight.
5. apply principles to identify portions of the structure of an aircraft which are most likely to be suffering from stress and fatigue cracks.
6. solve performance problems dealing with the failure of an engine on a multi-engine aircraft.

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:

- I. BASIC AERODYNAMICS
 - A. Wing and Airfoil Forces
 1. Properties of the Atmosphere
 2. Bernoulli's Principle and Subsonic Airflow
 3. Development of Aerodynamic Forces
 4. Flight at High Lift Conditions
 5. High Lift Devices
 6. Development of Aerodynamic Pitching Moments
 7. Friction Effects

- B. Planform Effects and Airplane Drag
 - 1. Effect of Wing Planform
 - 2. Induced Drag
 - 3. Effect of Taper and Sweepback
 - 4. Stall Patterns
 - 5. Parasite Drag
 - 6. Airplane Total Drag

II. AIRPLANE PERFORMANCE

- A. Required Thrust and Power
 - 1. Definitions
 - 2. Variation of Thrust and Power Required
- B. Available Thrust and Power
 - 1. Principles of Propulsion
 - 2. Turbojet Engines
 - 3. The Reciprocating Engine
 - 4. Aircraft Propellers
- C. Items of Airplane Performance
 - 1. Straight and Level Flight
 - 2. Climb Performance
 - 3. Range Performance
 - 4. Endurance Performance
 - 5. Off-Optimum Range and Endurance
 - 6. Maneuvering Performance
 - 7. Takeoff and Landing Performance

III. HIGH SPEED AERODYNAMICS

- A. General Concepts and Supersonic Flow Patterns
 - 1. Nature of Compressibility
 - 2. Typical Supersonic Flow Patterns
 - 3. Sections in Supersonic Flow
- B. Configuration Effects
 - 1. Transonic and Supersonic Flight
 - 2. Transonic and Supersonic Configurations
 - 3. Aerodynamic Heating

IV. STABILITY AND CONTROL

- A. Definitions
 - 1. Static Stability
 - 2. Dynamic Stability
 - 3. Trim and Controllability
 - 4. Airplane Reference Axes
- B. Longitudinal Stability and Control
 - 1. Static Longitudinal Stability
 - 2. Longitudinal Control
 - 3. Longitudinal Dynamic Stability
 - 4. Modern Control System
- C. Directional Stability and Control
 - 1. Directional Stability
 - 2. Directional Control
- D. Lateral Stability and Control
 - 1. Lateral Stability
 - 2. Contribution of the Airplane Components
 - 3. Lateral Dynamic Effects
 - 4. Control in Roll

- E. Miscellaneous Stability Problems
 - 1. Landing Gear Configuration
 - 2. Spins and Problems of Spin Recovery
 - 3. Pitch-Up
 - 4. Effects of High Mach Number
 - 5. Pilot Induced Oscillations
 - 6. Roll Coupling
 - 7. Helicopter Stability and Control

- V. OPERATION STRENGTH LIMITATIONS
 - A. General Definitions and Structural Requirements
 - 1. Static Strength
 - 2. Service Life
 - 3. Aeroelastic Effects
 - B. Aircraft Loads and Operating Limitations
 - 1. Flight Loads--Maneuvers and Gusts
 - 2. The V-n or V-g Diagram
 - 3. Effect of High Speed Flight
 - 4. Landing and Ground Loads
 - C. Effect of Overstress on Service Life

- VI. APPLICATION OF AERODYNAMICS TO SPECIFIC PROBLEMS OF FLYING
 - A. Primary Control of Airspeed and Altitude
 - B. Region of Reversed Command
 - C. The Angle of Attack Indicator and the Mirror Landing System
 - D. The Approach and Landing
 - E. The Takeoff
 - F. Gusts and Wind Shear
 - G. Power-Off Glide Performance
 - H. Effect of Ice and Frost on Airplane Performance
 - I. Engine Failure on the Multi-Engine Airplane
 - J. Ground Effect
 - K. Interference Between Airplanes in Flight
 - L. Braking Performance
 - M. Refusal Speeds, Line Speeds, and Critical Field Length
 - N. Sonic Booms
 - O. Helicopter Problems

REQUIRED READING:

Hurt, Hugh. Aerodynamics for Naval Aviators. Washington, D.C.: United States Government Printing Office, 1965.

SUGGESTED READING:

None.

REQUIRED WRITING:

None. This course involves considerable problem solving exercises, including algebraic equations, interpretation of charts/graphs, and application of aerodynamic principles to modern aircraft design.

OUTSIDE ASSIGNMENTS:

Students are expected to spend a minimum of three hours per unit per week in class and on outside assignments, prorated for short-term classes.

Reading and study of textbook.

I]NSTRUCTIONAL METHODOLOGY:

Check all that apply:

- lecture
- laboratory
- lecture-laboratory combination
- directed study

Lecture, discussion, numerous transparencies and visual aids are used.

DISTANCE LEARNING:

This course may be offered as a distance learning course and meets Title 5 regulations 55370, 55372, 55374, 55376, 55378, and 55380.

Yes No

If yes, check all that apply:

- Television Course (Video one-way, e.g. ITV, video cassette, etc.)
- Online Course (Text one-way, e.g. newspaper, correspondence, electronic file, etc.)
- Two-Way Video Conferencing (Two-way interactive video and audio)
- One-Way Video Conferencing (One-way interactive video and two-way interactive audio)
- Computer Assisted Instruction (A specialized form of mediated instruction relying primarily on student access to information and prepared lessons or teaching materials through a computer terminal, but not under immediate supervision of a qualified instructor.)

GRADING POLICY AND STANDARDS (include methods of determining whether the stated objectives have been met by students):

4 tests (true/false, multiple choice & short answer). Each test is 25% of the total course grade.

IS COURSE REPEATABLE FOR REASON(S) OTHER THAN DEFICIENT GRADE?

Yes No Number of times course may be taken for credit:

If yes, identify specific provision of Title 5 Division 2 section(s), 55761-55763 and 58161 which qualifies course as repeatable:

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SIGNATURES ON FILE