AEROSPACE
SHORT COURSES

Propulsion Systems for UAVs and General Aviation Aircraft (AERO0440)

Instructor: Ray Taghavi

Course Highlights

- Fundamentals of aircraft propulsion systems, engine types and aircraft engine selection
- Aircraft spark-ignition, diesel and Wankel engines
- Two-stroke and four-stroke cycle engines
- Aircraft engine classification by cylinder arrangement, cooling, cycle, etc.
- Carburetion, ignition and lubrication systems
- Aviation fuels
- Propellers
- Engine testing and simulations
- Electric propulsion
- Overview of turbo-propeller and turboshaft engines
- Engines for special applications, UAVs, RPVs, blimps, etc.

Course Description

This course provides an in-depth understanding of the state-of-the-art propulsion issues for UAVs and general aviation aircraft, including propulsion options, cycle analysis, principles of operation, systems, components, performance and efficiencies.

Who Should Attend?

Designed for propulsion engineers, aircraft designers, aerospace industry managers, educators, and research and development engineers from NASA, the FAA, and other government agencies.

Learning Objectives

- A broad knowledge of engines for UAVs and general aviation aircraft and their operation
- Engine selection process for a specific aircraft and UAVs
- Aircraft Engine Systems: Carburetion, fuel injection, FADEC, ignition and lubrication
- The advantages and disadvantages of different propulsion options
- Engine classifications based on cycle, cylinder arrangement, cooling, etc.
- Propellers: classifications, practical issues, definitions and systems
- Engine scaling
- Small engine simulations
- Electric propulsion

- Aircraft engine testing

Course Outline

Day One

- Overview: Fundamentals of aircraft propulsion systems, engine types and aircraft engine selection
- Aircraft reciprocating engines: spark ignition and diesel engines: theory and cycle analysis, four stroke and two stroke cycles; brake horsepower, indicated horsepower and friction horsepower; engine parameter, efficiencies, classifications and scaling laws; practical issues

Day Two

- Aircraft reciprocating engines (continued): components and classification: cylinder, piston, connecting rod, crankshaft, crankcase, valves and valve operating mechanism; lubrication systems, pumps, filters, oil coolers, etc.; induction system, supercharging, cooling (air and liquid), exhaust engine installation and compound engine; engine knocks (pre-ignition and detonation), aviation fuels, octane and performance number, backfiring and afterfiring

Day Three

- Aircraft reciprocating engines (continued): carburetion and fuel injection systems, FA DEC; magneto (high and low tension), battery and electronic ignition systems, ignition boosters and spark plugs
- Rotary engines: propeller: theory, types airfoils, material, governors, feathering, reversing, synchronizing, synchrophasing, de-icing, anti-icing and reduction gears

Day Four

- Small gas turbine engines: cycles, inlets, compressors, combustors, turbines, exhaust systems, thrust reversers and noise suppressors; turbojet, turboprop, turboshaft, turbofan and propfan engines

Day Five

- Engine noise: sources, suppression, measurement techniques and practical issues
- Foreign Object Damage (FOD): ice, sand, bird
- Engines for special applications: UAVs, RPVs, HALE, blimps

Classroom hours / CEUs

35.00 classroom hours
3.5 CEUs

Certificate Track

Aircraft Design
Unmanned Aircraft

Course Fees

Early registration course fee: $2,595 if you register and pay by the early registration deadline (45 days out).

Regular registration course fee: $2,795 if you register and pay after the early registration deadline.

Course Materials

Course materials, including outlines, presentation copies, and supplementary materials, will be accessible through Canvas, KU's online learning system. Instructions to access Canvas will be provided upon completed registration. Students are required to bring a computer or other electronic device with PDF-viewing capabilities with them to class each day. If you require accommodation contact us at professionalprograms@ku.edu and we will work with you on an accessible solution.

U.S. Federal Employee Discount

This course is available to U.S. federal employees at 10% off the registration fee. To receive the federal employee discount, you must enter the code **FGVT116** during the checkout process. Please note that you must validate your eligibility to receive this discount by entering your U.S. government email address (ending in .gov or .mil) when creating your online registration profile. This discount is available for both the early registration and regular registration fees.

Instructor Bio

Dr. Ray Taghavi is "John E. and Winifred E. Sharp Professor" & Associate Chair of the Aerospace Engineering Department at the University of Kansas. He teaches and conducts research in jet propulsion, rocket propulsion, aircraft reciprocating engines, fluid mechanics, aircraft aerodynamics, and advanced experimental techniques. Before joining the KU Faculty in 1991, he was a research engineer at NASA John Glenn Research Center, conducting experimental research on supersonic jet noise reduction techniques, acoustic excitation of free shear layers, and stability and control of swirling flows. He is the co-inventor and patent holder for a "supersonic vortex generator" and a "Novel Air Data Sensor with Power Scavenge System" for subsonic aircraft. He is a Fellow of the American Society of Mechanical Engineers (ASME) and an Associate Fellow of the American Institute of Aeronautics & Astronautics (AIAA). Dr. Taghavi has been the recipient of the Abe M. Zarem Educator Award from AIAA, the Ralph R. Teetor Educational Award from SAE, the John E. and Winifred E. Sharp Award from the KU School of Engineering (twice), Henry E. Gould Award from the KU School of Engineering, and is a four-time winner of the Aerospace Engineering Outstanding Educator Award from the graduating seniors of the department. Dr. Taghavi has received his Ph.D. in Aerospace Engineering from the University of Kansas in 1988.

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