Wits University & Embry-Riddle Aeronautical University – Dual Masters in Aeronautical Engineering

Course Descriptions

The minimum duration of the dual degree is 3 semesters. The degree structure is shown below in the table:

	Taught by Wits	**Taught by ERAU**
Semester 1	**MECN7066** Research Methods in Engineering[2]	**ASCI 602** Air Transportation System (Airline Analysis) **ASCI 604** Human Factors in the Aviation/Aerospace Industry
Semester 2	**Any one of the following:** **MECN 7001** Reliability Engineering **MECN 7006** Production and Operations Management **MECN 7017** Value Engineering and Analysis **MECN 7020** Manufacturing Strategy **MECN 7023** Management of Technology **MECN 7024** Maintenance Engineering **MECN 7026** Finite Element Methods **MECN 7028** Lean Manufacturing **MECN 7059** Supply Chain Management **MECN 7065** Service Engineering **MECN 7054** Systems Engineering: Hard Systems Methodologies **MECN 7058** Systems Engineering: Soft Systems Methodologies, or **MECN 7062** Systems Engineering: An Overview *Alternately a course may be selected from the ERAU list of courses*	**At least one of the following:** **ASCI 509** Advanced Aerodynamics **ASCI 511** Earth Observation and Remote Sensing **ASCI 515** Aviation/Aerospace Simulation Systems **ASCI 516** Applications in Crew Resource Management **ASCI 530** Unmanned Aerospace Systems **ASCI 560** Advanced Rotorcraft Operations **ASCI 601** Applications in Space: Commerce, Defense, and Exploration **ASCI 603** Aircraft and Spacecraft Development **ASCI 615** Aviation/Aerospace Accident Investigation and Analysis **ASCI 617** Airport Safety and Certification **ASCI 638** Human Factors in Unmanned Aerospace Systems **ASCI 643** Management of Research and Development for the Aviation/Aerospace Industry
Semester 3	**MECN 7018** Research Report	**ASCI 700a** Thesis I **ASCI 700b** Thesis II

Semester 1
University of the Witwatersrand Courses
MECN7066 Research Methods in Engineering
The course aims to prepare the student for the final submission of his/her research proposal. The course will cover research problem formulation, compiling, organising and critically reviewing literature, dividing problems into sub-problems, identifying required data, variables and controls and data analysis. The course will also familiarises the student with research methods and identification of types of data (qualitative or quantitative), different methods of data collection, and approaches to analysing both qualitative and quantitative data.
Back to the course layout.

Embry-Riddle Worldwide Course

ASCI 602 Air Transportation Systems

A study of air transportation as part of a global, multimodal transportation system, the course reviews the evolution of the technological, social, environmental, and political aspects of this system since its inception at the beginning of the previous century. The long-term and short-term effects of U.S. economic deregulation, energy shortages, governmental restraints, national and international issues, and international terrorism are examined. Passenger and cargo transportation, as well as military and private aircraft modes, is studied in relation to ever-changing transportation requirements.
Back to the course layout.

ASCI 604 Human Factors in the Aviation/Aerospace Industry

This course presents an overview of the importance of the human role in all aspects of the aviation and aerospace industries. Emphasis is on issues, problems, and solutions of unsafe acts, attitudes, errors, and deliberate actions attributed to human behavior and the roles supervisors and management personnel play in these actions. Students examine the human limitations in the light of human engineering, human reliability, stress, medical standards, drug abuse, and human physiology. Discussions include human behavior as it relates to the aviator's adaptation to the flight environment, as well as the entire aviation/aerospace industry's role in meeting the aviator's unique needs.
Back to the course layout.

Semester 2
University of the Witwatersrand Courses

MECN 7001 Reliability Engineering

Theories, measurement and managing dependable systems. Includes basic concepts, systems reliability, maintenance and replacement, testing for reliability, reliability prediction, system reliability evaluation, human reliability, RCM. Basic concepts. Failure probability density functions. Component reliability. Reliability of systems. Methods for determining reliability of systems. Active and standby redundancy. Testing for reliability. Sampling techniques. Prerequisite: Basic knowledge of Statistics.
Back to the course layout.

MECN 7006 Production and Operations Management

This course exposes the student to the broad scope of production and operations management, covering from high level strategic management philosophies down to day to day management tools. However the emphasis will be on tools that will help the student best manage at their level within the company. Emphasis will also be placed on the student's role in POMS in the workplace. The course structure will made up by lectures and case studies (these will form an important part of the teaching process).
Back to the course layout.

MECN 7017 Value Engineering and Analysis

History and application. Value systems – group dynamics. Planning of workshops. Information validation and objective setting. Definition and priority of functional requirements. Innovative and lateral thinking techniques. Function – cost relationship. Evaluation and decision analysis. Project reporting and implementation. Financial justification. Workshop application study.
Back to the course layout.

MECN 7020 Manufacturing Strategy

This course introduces students to the methods and techniques for analysing a manufacturing business from a strategic viewpoint. It integrates key concepts and frameworks encountered in various disciplines. While all the required strategy concepts will be covered in the unit, a basic knowledge of finance is assumed.
Back to the course layout.

MECN 7023 Management of Technology

Managing innovation and technological change. Strategic and tactical issues covering the process; technology transfer; research and development infrastructure; co-operation in research and development; technology and economic analysis; technology and human issues; commercialisation including intellectual property rights.
Back to the course layout.

MECN 7024 Maintenance Engineering

Maintenance objectives; RAM – Reliability, Availability and Maintainability; Maintenance organisation; Maintenance staffing and training; Maintenance planning and schedule; The work order system; Maintenance control – performance measures for internal control and benchmarking for comparisons with other companies and other industries; Maintenance inventory; Maintenance audits; Specific techniques: critical path analysis for the project management of outages, RCM for maintenance optimisation, condition monitoring; Computerised maintenance management systems (CMMSs); Maintenance contracts and penalty and reward systems; Total productive maintenance (TPM).
Back to the course layout.

MECN 7026 Finite Element Methods

Approximate methods; Raleigh-Ritz procedure; Energy methods; Formulation of the element stiffness matrix; Isoparametric elements; Axisymmetric analysis; Plate and shell structures; Dynamic problems; Practical applications. Computer packages will be extensively used.
Back to the course layout.

MECN 7028 Lean Manufacturing

This course introduces the principles of lean operations in manufacturing and service industries. Five lean principles, waste elimination; lean production systems; value stream mapping; managing extended supply chains; the lean enterprise; tools and terminology for fast, flexible flow. Lean and Six Sigma. Introduction to Lean in service, introduction to Lean new product introduction.
Back to the course layout.

MECN7054 Systems Engineering: Hard Systems Methodologies

Changing to a systemic paradigm, handling complexity and change, and developing a learning organization and providing challenging assignments in teams. Introduction to systems theory and the systems framework. Methodologies for problem solving and systems analysis. Applications areas. Selected topics on systems management. Case studies.
Back to the course layout.

MECN7058 Systems Engineering: Soft Systems Methodologies

The course introduces the basic concepts and motivation for applying Systems Engineering principles. Basic concepts are be introduced, for example, “What is a system?”, “What is a system lifecycle?” and “What is systems thinking?”. Hard Systems principles are covered, for example: Capture and understand the problem before committing to the solution. Modelling notations for SE are introduced that support understanding, reasoning and communication about the system. An implicit architecture framework underlying the modelling notation is presented.
Prerequisite: At least 3 years of relevant working experience in industry
Back to the course layout.

MECN7059 Supply Chain Management

The course aims to give an in-depth coverage of Supply Chain management and Logistics in the context of contemporary operations, taking into account the major competitive drivers of efficiency and responsiveness and the solutions enabled by new technologies. The module addresses the scope, impact and importance of SC and Logistics management and the major decisions that need to be made in today's world of global supply and global markets.
Back to the course layout.

MECN7062 Systems Engineering: An Overview

The course aims to provide the student with a global understanding of Systems Engineering history, concepts and role in everyday business practice. The course examines the concepts of Soft and Hard Systems Methodologies, and, through case studies, how a Systems Approach can be used to integrate a number of interrelated disciplines such as: x Project management. x Lean concepts. x Information technology and x Innovation.
Back to the course layout.

MECN7065 Service Engineering

The course aims to give an in-depth coverage of Service engineering in the context of contemporary operations, taking into account the major competitive drivers of efficiency and responsiveness and the solutions enabled by new technologies. The module addresses the scope, impact and importance of service engineering and the major decisions that need to be made in today's world of a globally connected service based economy. In this context, the field of service engineering enables us to innovate, design, and manage simple and complex service operations and processes of the intelligent service-based economy.
Back to the course layout.

Embry-Riddle Worldwide Courses

Note: All classes are not offered every Semester

ASCI 509 Advanced Aerodynamics

In this course, students will examine current flight applications and problems. Specifically, this includes transonic, supersonic, and hypersonic aerodynamics, principles of aircraft stability and control, and operational strength considerations. Emphasis is placed on the applications of the rapidly changing technological innovations in aerodynamics and the solutions to the problems created by these advances.
Back to the course layout.

ASCI 511 Earth Observation and Remote Sensing

U.S. and International solar system exploration programs are reviewed and related to the current and proposed Earth-research projects. Examination of these research programs will be structured towards defining problems related to environmental changes and resource exploration. Formatted research data from Earth-resource satellites and EOS sources will be used for demonstrating specific research techniques, exploration methods, and economic and social elements of exploration.
Back to the course layout.

ASCI 515 Aviation/Aerospace Simulation Systems

The course focus is on a comprehensive examination of simulation in modern aviation/aerospace that includes history, state-of-the-art, and current research and development. Discussions focus on the extent and impact of simulator application throughout the industry and the effects on training costs and safety. Topics range from basic design principles to flight crew training for initial qualification, continuation and currency purposes. The course emphasizes implementation of

training that is transferable from simulated to real world environments. Systems simulators to the simulation models used in management, flight operations, scheduling, or air traffic control, are examined in detail.
Back to the course layout.

ASCI 516 Applications in Crew Resource Management

In this course, students examine the common concepts of crew resource management (CRM) as developed by major air carriers and explore the theoretical basis of such training. Topics such as supervision of crewmembers, counseling, manner and style, accountability, role management, and use of simulators and computer-based instruction will be studied. Each student has the opportunity to become knowledgeable in a specific area of CRM by assisting in the development of a CRM research document as part of the course.
Back to the course layout.

ASCI 530 Unmanned Aerospace Systems

This course offers a conceptual approach to overall system design of unmanned aircraft and spacecraft systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems. Course will include the concepts of communication systems, payload systems, control stations and related systems, vehicle specific systems, and support systems. The requirements for system architecture development and conceptual level assessment of major system elements will be examined as they relate to use in industry. The major system elements will be evaluated from a systems engineering perspective to include consideration for cost and weight estimation, basic aircraft performance, safety and reliability, lifecycle topics, vehicle subsystems, and system integration.
Back to the course layout.

ASCI 560 Advanced Rotorcraft Operations

The course introduces the complexities of rotary wing flight systems and the advancements made to overcome them. The unique problems facing an organization involved in rotorcraft operations are studied, from the initial inception of a program to the government rules and regulations, environmental and noise considerations, special landing and take-off facilities, flight and maintenance ratings, and techniques of control. Special consideration is given to the unique problems and issues facing such rotorcraft operations as police, medical evacuation, forestry service, and corporate aviation.
Back to the course layout.

ASCI 601 Applications in Space: Commerce, Defense, and Exploration

The scientific, military, and commercial interests in international and domestic space programs are examined throughout the history of space flight. The needs of commercial space endeavors and methods of expanding space technology into manufacturing are contrasted to the importance of scientific exploration, and the requirements of military space operations. The justification, development, and costs of scientific exploration programs, defense-related projects, and commercial endeavors are used to study the evolution of space missions and the development of future programs.
Back to the course layout.

ASCI 603 Aircraft and Spacecraft Development

This course is an overview of aircraft and spacecraft development. Included are vehicle mission, the requirements directed by economics, the military and defense considerations, and the research and developmental processes needed to meet the vehicle requirements. Aviation and aerospace manufacturing organizations and techniques are addressed to include planning, scheduling, production, procurement, supply and distribution systems. The course studies aviation and aerospace maintenance systems, from the built-in test equipment to the latest product support activities.
Back to the course layout.

ASCI 615 Aviation/Aerospace Accident Investigation and Analysis

This course covers all aspects of the aircraft accident investigation process starting with preparation for investigation through report writing. Particular emphasis is placed on the study of human factors connected with flight and support crews activities in aviation operations. The course provides students with knowledge of the process of investigating accidents and incidents in an aviation organization. A critical analysis of selected aircraft accidents and an evaluation of causal factors are covered.
Back to the course layout.

ASCI 617 Airport Safety and Certification

This course provides a review and analysis of all Federal regulations applicable to safe conduct of airport operations. The requirements for airport certification are covered as well as airport environmental protection and occupational safety compliance. Day-to-day safe operations are emphasized.
Back to the course layout.

ASCI 638 Human Factors in Unmanned Aerospace Systems

This course is designed to present an overview of the importance of major human factors issues associated with unmanned systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems operations across a variety of platforms employed in both commercial and military operations. Emphasis will be placed on the differences and commonalities between occupied and unoccupied systems, with a focus on the human factor issues encountered by individual unmanned operators (pilots and sensor operators) as well as UAS teams. Students will become familiar with human factor issues surrounding unmanned launch, recovery, long duration operations, fatigue, human performance, Ground Control Station (GCS) design, use of automation, Situation Awareness (SA), Crew Resource Management (CRM), integration into the National Air Space (NAS), attitudes and perspectives of both government agencies and public entities, use of technology to compensate for no-pilot-onboard, and regulatory issues and solutions. Discussions of human capabilities and limitations as it relates to safe and effective operation of unmanned aircraft and space systems in a variety of commercial and military operations will be included.
Back to the course layout.

ASCI 643 Management of Research and Development for the Aviation/Aerospace Industry

The types and sources of aviation/aerospace research and development are analyzed, with a focus on the structure and interrelationship of the industry, educational institutions, and other organizations. Sources and methods of funding, specification determination, the relationship of research and development to procurement and production, and the regulatory factors affecting progress from the initial development to production of the aircraft and components are examined. Concepts of motivation and management as applied to research scientists and engineers will be studied as well as procedures for promoting optimum creativity concurrently with efficient operations.
Back to the course layout.

Semester 3
University of the Witwatersrand Course

MECN 7018 Investigational Project

This is a full research project conducted by the student under the supervision of a member of staff. Completion of the course is through the accomplishment of a thesis which is required to be completed in accordance with the requirement of the School of Mechanical, industrial and Aeronautical engineering.

Embry-Riddle Worldwide Courses

ASCI 700a Thesis I

This course is the first of a two course sequence (ASCI 700A and ASCI 700B) to complete the degree program through the accomplishment of a thesis. The student will propose and begin to develop a written document on an aviation/aerospace topic, supervised throughout its preparation by the student's Thesis Committee. The document is intended to demonstrate the student's mastery of the topic and be of satisfactory quality for publication. Following satisfactory performance within this course, the student will continue on to ASCI 700B for the completion and submittal of the thesis.
Back to the course layout.

ASCI 700b Thesis II

This course is the second of a two course sequence (ASCI 700A and ASCI 700B) to complete the degree program through the accomplishment of a thesis. The student will complete their thesis under the supervision of the student's Thesis Committee. The document is intended to demonstrate the student's mastery of the topic and be of satisfactory quality for publication. Following satisfactory performance within this course, the student will be permitted to graduate from the program.
Prerequisites: ASCI 700A.
Back to the course layout.