# ESSLINGEN UNIVERSITY

# INTAP

## INTERNATIONAL AUTOMOTIVE ENGINEERING PROGRAM

**Esslingen University**
Kanalstrasse 33
73728 Esslingen
Germany

Incoming@hs-esslingen.de

Faculty of Mobility and Technology
and International Centre

# INTRODUCTION

The International Automotive Engineering Program, INTAP, was originally developed in conjunction with Kettering University (former GMI) in Flint, Michigan, USA.

The basic idea was to extend international student exchanges. The primary objectives were to offer interesting lectures in automotive competency and to give participants cultural and historical impressions. In addition the program offers a variety of field trips to the German car industry, its suppliers and other scenic places in Germany. The credits of the lectures are usually accepted at our partner universities.
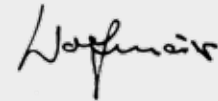
In the meantime we have developed INTAP into one of the most important and one of the most successful international programs at Esslingen University. The program has been running for more than 20 years. During the last couple of years we have focussed more and more on the international aspect in its proper meaning. This means that we try to accept students of different nationali-ties from partner universities all over the world in order to give the student the opportunity to learn from other cultures and mentalities. The program is offered to the open market, which could well be one of the main attractions of INTAP.

The lectures start once a year in the fall semester, running from October to December. In September the International Office organizes an orientation program consisting of an intensive German Class at beginners and advanced levels, assistance with administrative procedures and the opportunity to get in touch with other international students. These orientation weeks are a mandatory part of the program, as they make the integration here much easier.
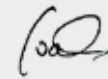
Each semester the International Office of Esslingen University will provide the coordinators of our partner universities with the exact application deadline, information about the application procedure and program schedule. Therefore, please contact your coordinator for more detailed information. The course language is English. The number of participants is limited to 20 members.

We are looking forward to receiving your applications.

You are warmly welcome!

**Prof. Christof Wolfmaier**
President of Esslingen University

**Prof. Berkemer**
Academic Coordinator INTAP

## TABLE OF CONTENTS >>>>>>

# CHOICE OF COURSES

### PROPULSION SYSTEMS
Prof. Dr.-Ing. Michael Auerbach
Phone +49(0)711 397-3487, Michael.Auerbach@hs-esslingen.de,
Room S 02.001

### BASIC ELEMENTS OF FEEDBACK CONTROL TECHNOLOGY
Prof. Dr.-Ing. Joachim Berkemer
Phone +49(0)711 397-3376, Joachim.Berkemer@hs-esslingen.de,
Room S 04.005

### COMPUTER SIMULATION IN AUTOMOTIVE ENGINEERING
Prof. Dr.-Ing. Thomas Schirle
Phone +49(0)711 397-3232, Thomas.Schirle@hs-esslingen.de,
Room  14.204

### FINITE ELEMENT ANALYSIS (FEA)
Prof. Dr.-Ing. Carsten Block
Phone +49(0)711 397-3203, Carsten.Block@hs-esslingen.de,
Room  05.105

### FLUID MECHANICS
Prof. Dr.-Ing. Christian Saumweber
Phone +49(0)711 397-3633, Christian.Saumweber@hs-esslingen.de,
Room S 02.210

### GERMANY AT A GLANCE
M.A. Mr. Holger Starzmann
E-Mail: Holger.Starzmann@hs-esslingen.de

### GERMAN AS A FOREIGN LANGUAGE
Team of German Language Lecturers

# IMPORTANT CONTACT INFORMATION

### INTERNATIONAL OFFICE
incoming@hs-esslingen.de

### FACULTY OF MOBILITY AND TECHNOLOGY
Academic Coordinator
Prof. Dr.-Ing. Joachim Berkemer
Phone +49(0)711 397-3376, Joachim.Berkemer@hs-esslingen.de

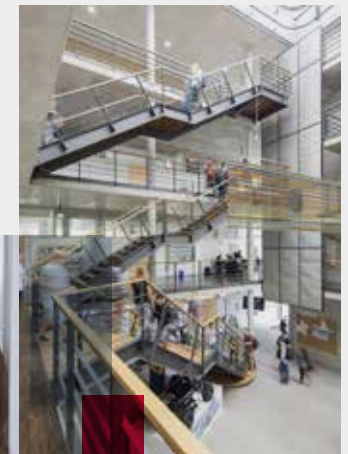### INTERNATIONAL CENTRE AND GRADUATE SCHOOL
Programme Management
M.A. Ms. Kremena Daneva
Phone +49(0)711 397-3335, Kremena.Daneva@hs-esslingen.de

### POLICE
Phone 110 (all over Germany)

### EMERGENCY/FIRE BRIGADE
Phone 112 (all over Germany)

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# FIELD TRIPS

### AS PART OF THE PROGRAM "INTERNATIONAL FRIENDS"
l    Neuschwanstein (castle)
l    Heidelberg (castle and historic town center)
l    Lake Constance (Zeppelin museum, castles and historic
     town center, boat trip)
l    Tübingen (city tour with historical site visits)

### AS PART OF DEPARTMENTAL ACTIVITIES
l    Mercedes plant, Sindelfingen
l    Mercedes plant, Stuttgart-Untertürkheim
l    Porsche plant, Stuttgart-Zuffenhausen
l    Audi plant, Neckarsulm
l    Robert Bosch plant, Reutlingen or Stuttgart-Feuerbach

A selection of the excursions from the above list is planned
every year.

# PROPULSION SYSTEMS

### INSTRUCTOR
Professor Dr. Michael Auerbach

### PREREQUISITES
Basic courses in engineering mechanics and mathematics

### TOPICS   (1 h = 45 min)
**Part 1 Basics on components**
l    Vehicle performance: Demands for drivelines Propulsion
     Systems Basics
l    Electrical Systems
l    Gearboxes and Components
l    Combustion Engines
l    Powertrain Simulation using Matlab/Simulink

**Part 2 Powertrain Development**
l    ICE-driven Propulsion Systems
l    Hybrid Propulsion Systems
l    Pure Electric Propulsion Systems

>>> **Total    40 h**

# BASIC ELEMENTS OF FEEDBACK CONTROL TECHNOLOGY

## TEXTBOOK/REFERENCE MATERIALS
Lecture notes

## ASSESSMENT & COURSEWORK
Written Midterm and Final exam (2 x 90min)

## ESTIMATED ABET CATEGORY CONTENT
Theory: 4 credits

## ECTS CREDITS
4 credits

**GOALS** >>>>>>

The course gives an insight on current and future technologies for propulsion systems by exploring electric, electrified and also classic propulsion systems.

## INSTRUCTOR
Prof. Dr.-Ing. Joachim Berkemer

## PREREQUISITES
I    Mathematics
I    Mechanical Engineering
I    Electrical Engineering

## TOPICS   (1 h = 45 min)
I    Introduction to continuous-time control
I    Descriptions of control loop elements
I    Elementary transfer elements (P, I, D, dead time
I    Lag elements (PT1, IT1, DT1, PT2)
I    Composition of transfer elements for control equipment
     Modelling of transfer systems
I    Nyquist plots, Bode diagrams, stability
I    Controller design and control loop synthesis

>>> **Total   40 h**

## TEXTBOOK/REFERENCE MATERIALS
Bilingual (German/English) handouts; Authors: Prof. Heinrich Abel,  Prof. Hermann Kull, Prof. Jürgen van der List, Prof. Douglas P. Looze, Prof. Gerhard Walliser

## ASSESSMENT & COURSEWORK
Written Midterm and Final exam (2x 90 min)

## ESTIMATED ABET CATEGORY CONTENT
Theory: 4 credits

## ECTS CREDITS
4 credits

**GOALS   >>>>>>**

The course should give the basic theoretical knowledge necessary for the use of modern applications of control technology.

# COMPUTER SIMULATION IN AUTOMOTIVE ENGINEERING

## INSTRUCTOR
Professor Dr. Thomas Schirle

## PREREQUISITES
I    Mathematics (desirable but not mandatory): solution
     of systems of linear ODEs, eigenvalues and eigenvectors
I    Engineering mechanics, linear vibration theory
I    Basic Computer programming (desirable but not mandatory):
     any programming language

## TOPICS   (1 h = 45 min)
I    Simulation and simulation tools in automotive engineering
I    Notation: processes, systems, models, state systems
I    Mathematical modeling of a car suspension
I    Introduction to MATLAB/SIMULINK
I    Numerical aspects: integration methods, stability, accuracy
     treatment of nonlinearities (play, dry friction, stops, etc.)

## LABORATORY PROJECTS   (1 h = 45 min)
I    Modeling, programming and simulation of a car suspension
I    SIMULINK model of a car suspension
I    SIMULINK S-Function for embedding of user defined models
I    State Space form of a car suspension LTI model
I    Automatic linearization of nonlinear systems
I    Modeling approaches for a nonlinear shockabsorber
I    „Skyhook" damping concept for active suspenison systems
I    Active suspension system with road preview (mechanics,
     hydraulics, control)
I    Simulation of system performance

>>> **Total   40h**

## TEXTBOOK/REFERENCE MATERIALS
Printed handout

## ASSESSMENT & COURSEWORK
Written Midterm and Final exam (2x 60 min)

## ESTIMATED ABET CATEGORY CONTENT
4 credits

## ECTS CREDITS
4 credits

**GOALS   >>>>>>**

I    To understand basic concepts, strength
     and weaknesses of dynamic systems
     simulation in the design process
I    To apply software for programming and
     dynamic system simulation
     (MATLAB/ SIMULINK)
I    To gain insight into possible numerical
     effects  and suitable solver methods

# FINITE ELEMENT ANALYSIS (FEA)

## INSTRUCTOR
Professor Dr. Carsten Block

## PREREQUISITES
Basic courses in engineering mechanics and mathematics

## TOPICS   (1 h = 45 min)
I     Introduction to finite element analysis and ANSYS
I     Data transfer from CAD to FEA
I     Modelling, meshing, applying loads and boundary conditions
I     Determination of displacements and stresses in beams, trusses and three-dimensional bodies
I     Validation and Verification in FEA
Laboratory Work
I     Introduction to ANSYS Workbench
I     Application to example problems (beams, trusses, three-dimensional bodies)
Group Project
I     Use of FEA to solve an engineering problem
I     Documentation in a professional engineering report

>>> **Total   40 h**

## TEXTBOOK/REFERENCE MATERIALS
Lecture notes

## ASSESSMENT & COURSEWORK
in-class exercises; project work

## ESTIMATED ABET CATEGORY CONTENT
Theory and practical work: 4 credits

## ECTS CREDITS
4 credits

<<<<<< **GOALS**

I     Formulate, analyse, and verify mechanical system analysis problems using an industry standard finite element analysis (FEA) software
I     Understand the structure and operation of a commercial FEA program (ANSYS)
I     Analyse deformations, forces, strains and stresses under a variety of loading conditions, including static and dynamic load cases.

# FLUID MECHANICS

## INSTRUCTOR
Professor Dr. Christian Saumweber

## PREREQUISITES
Introductory physics and mathematics courses.

## TOPICS   (1 h = 45 min)
I     Conservation equations of fluid mechanics
I     Basic concepts of CFD (Computational Fluid Dynamics)
I     Similitude
I     Compressible flows     6h

>>> **Total   40 h**

## TEXTBOOK/REFERENCE MATERIALS
Lecture notes

## ASSESSMENT & COURSEWORK
Written Midterm and Final exam (2x 90 min)

## ESTIMATED ABET CATEGORY CONTENT
4 credits

## ECTS CREDITS
4 credits

<<<<<< **GOALS**

This course is an introduction to the fundamental concepts of fluid dynamics. It provides the basic tools necessary to apply the conservation principles of mass, momentum and energy to non-viscous and viscous fluids in the analysis of engineering systems.

# GERMANY AT A GLANCE:
# HISTORY, POLITICS AND CULTURE

### INSTRUCTOR
M.A. Mr. Holger Starzmann

### PREREQUISITES
None

### TOPICS  (1 h = 45 min)
l    Introduction: general aspects of German history
l    The first Germans and the Romans
l    The Mediaeval period - Encounter between Orient and Occident
l    The Reformation and Restoration
l    Formation of the Prusso-German nation-state and
     World War I
l    The Weimar Republic
l    The Third Reich and World War II
l    Germany in a bipolar world
l    The rush to German unity
l    The German political system
l    People and Culture: Language, Religions, Holidays and Traditions
l    Todays Germany in Europe and in the European Union

### TEXTBOOK/REFERENCE MATERIALS
l    Detwiler, D.S. A Short History of Germany.
     Southern Illinois University Press, 1989
l    Fulbrook, Mary. German History Since 1800. .
     London: Bloomsbury Academic, 2010
l    Jarner, Peter, ed. Modern Germany: Politics, Society
     and Culture.m London: Routledge, 1998
l    Jones, Alun. The New Germany: A Human Geography.
     New York: Wiley/Longman,1994
l    Jarausch, Konrad H. The Rush to German Unity.
     Oxford University Press, 1994
l    Wehling, Hans-Georg. The German Southwest.
     Baden-Wuerttemberg: History, Politics, Economy and Culture.
     Stuttgart: Kohlhammer, 1991
l    Fulbrook, Mary. German History Since 1800. .
     London: Bloomsbury Academic, 2010
l    Additional materials, maps, newspaper and online articles
     and handouts

l    Online-Sources:
     http://www.spiegel.de/international/
     http://edition.cnn.com/
     http://www.ft.com/home/europe

### ASSESSMENT & COURSEWORK
l    Oral presentation and final exam
l    Participation in class

### ESTIMATED ABET CATEGORY CONTENT
4 credits

### ECTS CREDITS
4 credits

**GOALS  >>>>>>**

This course introduces students to German history from the Middle Ages to the Berlin Republic. It covers major events in medieval and early modern times, such as the German Reformation and the Thirty Years War, but the main focus is on the nineteenth and twentieth centuries.
In particular, the course will involve the study of the German Confederation, the formation of the Prusso-German nationstate and the imperial era, the period of the World Wars, and the history of the two Germanys after the end of the Third Reich and their path to the reunification. On completion of the focus on history, students will be familiar with basic knowledge in German geography, the political system and the cultural legacy of Germany.

# GERMAN AS A FOREIGN LANGUAGE LEVEL A1

### INSTRUCTOR
M.A. Ms. Karin Böse-Janissek

### PREREQUISITES
No technical prerequisites.
Participation of the online assessment test before
arrival

### TOPICS   (1 h = 45 min)
The basic course covers a large amount of practical training of
the German standard language. Typical matters of the students in
everyday situations are important. Emphasis is placed on develo-
ping and training sound communicative skills to be able to function
independently in all situations inside and outside the university.
A variety of basic topics and authentic situations from daily life are
used, e.g. grocery shopping, small talk, orientation in the city.

### MAIN GRAMMATICAL TOPICS
I    Conjugation of verbs (regular and irregular) in the present
     tense, verbs with vowel change
I    Personal pronouns, possessive pronouns
I    Genders of nouns, definite and indefinite articles, negative
     articles in nominative and accusativeW-questions, yes/no
     questions
I    Modal verbs „können" (be able to), „mögen" (like to),
     „möchten" (would like to)
I    Negative statements
I    Preterite (simple past) of „haben" (have) and „sein" (be)
I    Singular, plural
I    Connectives „aber" (but), „oder" (or), „und" (and)
I    Word order in statements, W-questions, yes/no questions,
     sentences with modal verbs.
I    Time indications.

### PROJECTS
1 excursion – visiting a production company
(e.g. Kessler Sekt – Esslingen)

### TEXTBOOK/REFERENCE MATERIALS
Information about the textbook and additional learning materials
will be given by the teacher in the first lesson

### ASSESSMENT & COURSEWORK
Final exam
Participation in class

### ESTIMATED ABET CATEGORY CONTENT
4 credits

### ECTS CREDITS
4 credits

Students arriving with a good command of German language may
take the assessment test for German language classes for STIPUS
students and, depending on the test performance, join the courses
at advanced levels.

**GOALS   >>>>>>**

The International Office offers "German as a
foreign language" courses on different levels
for international exchange students and free
mover students. During orientation, stu-
dents participate in a brief written test and
oral inter-view to evaluate  which level fits
best. Small groups allow students an active
exchange of ideas with teachers and other
students. During the courses, students will
apply skills required for communication in the
German standard language and – for advan-
ced learners – in the scientific language

# EXAMPLE OF A TYPICAL INTAP SCHEDULE

| TIME | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY |
|------|--------|---------|-----------|----------|--------|
| 07:35 am – 09:05 am | | | | | |
| 09:30 am – 11:00 am | Computer Simulation | | Propulsion Systems | Field trip | Feedback Control |
| 11:15 am – 12:45 pm | Computer Simulation | Fluid Mechanics | Propulsion Systems | Field trip | Feedback Control |
| | | | | | |
| 02:00 pm – 03:30 pm | | Fluid Mechanics | FEA | Field trip | |
| 03:45 pm – 05:15 pm | | | FEA | Field trip | |
| 05:30 pm – 09:00 pm | | Germany at a glance | German as a foreign language | Field trip | |