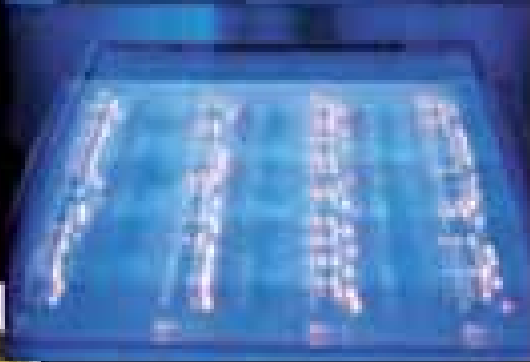# TAIST Tokyo Tech

[Thailand Advanced Institute of Science and Technology

and Tokyo Institute of Technology]

Tokyo Tech – NSTDA – Thai Universities Joint Graduate Institute

TAIST Tokyo Tech (Thailand Advanced Institute of Science and Technology Tokyo Institute of Technology)

Tokyo Tech-NSTDA-Thai Universities Joint Graduate Institute

It is our great pleasure to announce that the Thailand Advanced Institute of Science and Technology (TAIST) will be established as of June 2007, in Bangkok, the Kingdom of Thailand.

Tokyo Institute of Technology, as you are certainly aware, has made a great deal of contribution to educational and research cooperation in the Kingdom of Thailand over the years, especially in the field of science and technology. This includes JICA projects and JSPS Core University Programs. In September of 2001, we signed on the MOU with NSTDA (National Science and Technology Development Agency) for the promotion of academic collaboration.

TAIST is a leading institution of higher learning, a graduate school in the field of science and technology administrated through the cooperation of NSTDA and some Thai universities. It will produce outstanding scientists and engineers who will contribute to the development of Thailand.

We sincerely hope that the establishment of this institute will make a significant step forward in the further strengthening of the cordial relations already existing between Japan and the Kingdom of Thailand. Your kind assistance to support this initiative would be very much appreciated.

Dr. Chitoshi MIKI
Executive Vice President
Tokyo Institute of Technology

Research and Development is the core mission of National Science and Technology Development Agency (NSTDA). The primary objective is to help support sustainable competitiveness of the nation. Currently, there are over 500 researchers graduated with Master's and Ph.D. degrees from renowned universities all over the world working in the four national centers within NSTDA. On top of that, we also have the state-of-the-art facilities and equipment to support these people in their pursuing of new knowledge.

NSTDA has been contemplating collaboration with universities domestic and abroad to establish virtual Graduate Degree School to help relief growing demand of postgraduate personnel in industrial sector. We consider this as an important complimentary mission to enhance overall R&D activities of the country in order to transform Thailand into a new knowledge-based society. Besides, NSTDA looks forward to having substantively increasing number of young and talented students working with our researchers in NSTDA's laboratories. This would help stimulate an environment conducive for dynamic and creative pursuit of knowledge.

NSTDA is very privileged and happy to be able to conclude an agreement with Tokyo Institute of Technology, King Mongkut Institute of Technology Lardkrabang (KMITL) and Sirindhorn Institute of Technology (SIIT) to start the first Graduate Degree course of this virtual university concept. We have agreed to begin with Automotive Engineering as demand for human resources in the area has been immense during the past few years and will be definitely growing.

I personally wish this collaboration with Tokyo Institute of Technology in Thailand Advanced Institute of Science and Technology (TAIST Tokyo Tech) will expand to new disciplines which are of mutual benefit.

I wish this first Program of Automotive Engineering the most success and expect it will set a good model for future collaboration with other institutes.

Dr. Sakarindr Bhumiratana
President
National Science and Technology Development Agency

Following a vision of the president of King Mongkut Institute of Technology Ladkrabang (KMITL), collaboration in research and development with a leading national research institute such as NSTDA and a world-class university such as Tokyo Institute of Technology will enhance students' research capabilities and enforce the academic strength in science and technology of the nation. KMITL is very pleased in making a significant contribution to the establishment of TAIST.

It is our goal at KMITL that students will be provided with the state-of-art in knowledge and skills which are very much in need for Thailand in strengthening competitiveness in science and technology. We are delighted that several organizations have worked together to establish TAIST by awarding the degree under KMITL and our counterpart, Sirindhorn International Institute of Technology (SIIT). It will be the place where academic strength of the universities synergizes the research facilities and skills of the national research institutes. This will enable the students to get to know and make significant impacts to world-class researches in the strategic areas of the country, such as Automotive, Information and Communication Technology, Bioscience and Biotechnology, Environment, etc. With such cooperation, the first program leading to Master degree in Automotive Engineering has been established.

We also hope that this organization will initiate closer relationships among the national research institutes and the universities and will offer a better opportunity to the best and the brightest graduates. As a consequence, this will increase the number of highly qualified personnel in science and technology for Thailand.

Dr. Jarruwat Charoensuk
Dean
School of Graduate Study
King Mongkut Institute of Technology Ladkrabang

TAIST Tokyo Tech (Thailand Advanced Institute of Science and Technology Tokyo Institute of Technology)

1. Background

TAIST (Thailand Advanced Institute of Science and Technology) is based on the idea of collaboration among NSTDA and partner universities in Thailand and a foreign institution to develop the Thai human resources. TAIST will serve as a virtual institution and focal point. NSTDA will provide researchers to act as adjunct professors, research projects and scholarships for graduate students. A foreign institution or university will provide a world class background, expertise and experience, academic instruction and research advice. Thai universities will provide an academic frame work, academic staff to oversee and guide students and degrees for the successful candidates. The viability of the idea is nicely demonstrated by the creation of the first TAIST, namely **TAIST Tokyo Tech**, with the cooperation of Tokyo Institute of Technology (Tokyo Tech), King Monkut Institute of Technology Ladkrabang (KMITL) and Sirindhorn International Institute of Technology (SIIT). It is expected that several similar collaborations will be established in the future.

The main objective of **TAIST Tokyo Tech** is to establish an institution for human resource development to foster and support world-class researchers and high-level engineers through a combination of advising from Tokyo Tech professors, excellent facilities and research staff in NSTDA, and established resources of Thai universities. At present, the participating universities are KMITL and SIIT; more universities from Japan and Thailand are expected to join in the near future. The structure of **TAIST Tokyo Tech** is described in Fig.1.
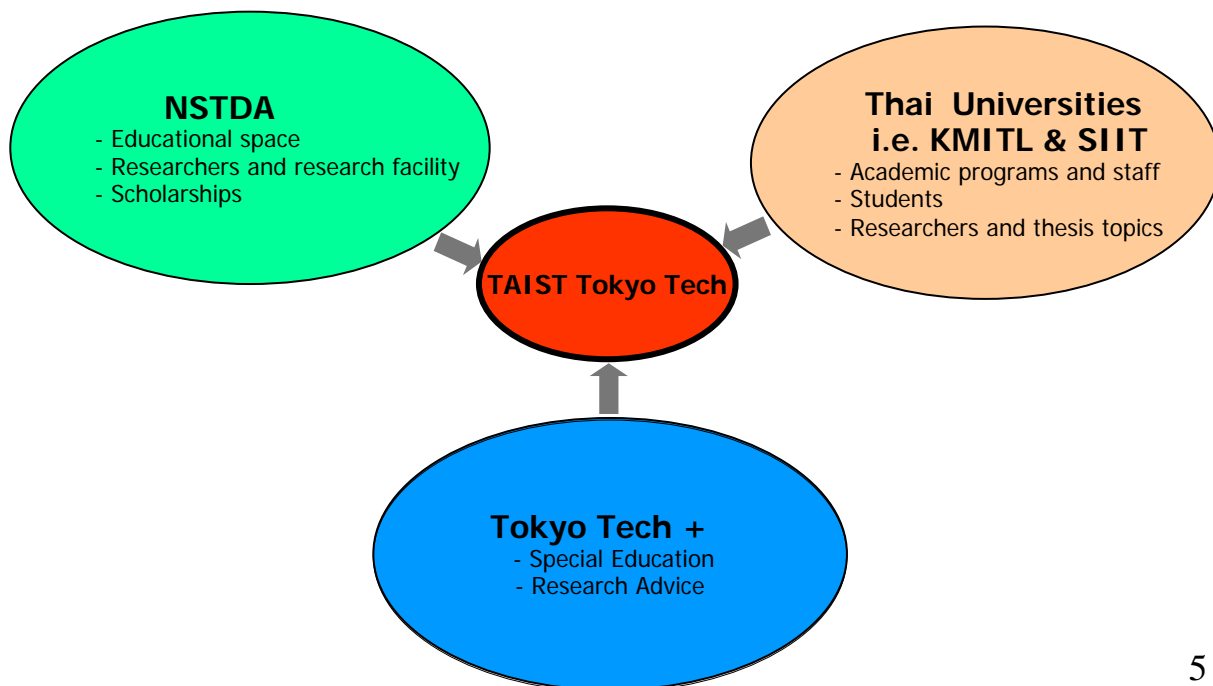

NSTDA
- Educational space
- Researchers and research facility
- Scholarships

Thai Universities i.e. KMITL & SIIT
- Academic programs and staff
- Students
- Researchers and thesis topics

TAIST Tokyo Tech

Tokyo Tech +
- Special Education
- Research Advice

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Fig. 1 Structure of TAIST Tokyo Tech

TAIST Tokyo Tech aims to harmonize advanced technology with the environment and to realize research and human resource development for global sustainable development. Looking back at the history of modernization through industrial development, factors such as global warming, abnormal weather and the pollution of air, water and soil indicate that there is a real risk of serious destruction of nature and life in the near future. It is urgent for us to recognize this paradigm shift in science and technology and concentrate our effort and intelligence on technologies which are in harmony with the environment. In Thailand, development and industrialization have been so drastic, compared with developed countries, that problems derived from these factors are much more serious as they become obvious. In light of such a situation, expanding research and education to harmonize advanced technology with the environment effectively and efficiently will be quite necessary and the outcome of such effort will be valuable not only for Thailand, but also other countries of the world.

The establishment of this joint graduate program will be a historical step for Tokyo Tech, which aims to be one of the top science and technology universities in the world. The first phase in creating this program is the exchange of academic staff and students according to agreements set forth by two institutions. The second phase is to facilitate lectures accredited in recipient universities through a distance education system as has already been conducted in both Thailand and the Philippines. The third phase is to establish an internationally cooperative graduate institute as well as to conduct HRD through education and researches. Many European and Australian universities are quite active not only in terms of accepting foreign students, but also in providing education in overseas campuses. The establishment of **TAIST Tokyo Tech** is extremely important since Tokyo Tech is now coming onto center stage, and with joint cooperation between Tokyo Tech and Thai partners, **TAIST Tokyo Tech** will become a similarly prominent institution.

The **TAIST Tokyo Tech** project will maintain a competitive edge over those of western countries by mobilization of whole institutional resources based on long history of education and research of Tokyo Tech, NSTDA, KMITL, SIIT and other participating universities. Tokyo Tech and **TAIST Tokyo Tech** share the same philosophy of education and research - "HRD by promoting cutting-edge research activities". It is expected that **TAIST Tokyo Tech** will initiate the start of a positive spiral of human resource development system in Asian region.

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2. Location and operation of TAIST Tokyo Tech

2-1. Location

- **TAIST Tokyo Tech** will be established at NSTDA in Thailand Science Park (TSP)

- Research and education will be conducted at the research institutions under NSTDA, namely NECTEC, MTEC, BIOTEC, NANOTEC and TMC and at the participating universities, namely KMITL and SIIT.

2-2. Students

- **TAIST Tokyo Tech** will eventually have master's and doctoral level programs. The master's program will be set up first, and the doctoral program will be initiated at a later stage.
- In the first year, all students will be Thai. Later, it is expected that **TAIST Tokyo Tech** will also accept students from other Asian countries and all over the world.
- Students will be registered at KMITL under **TAIST Tokyo Tech** program. NSTDA will award scholarships to all **TAIST Tokyo Tech** students.
- Successful **TAIST Tokyo Tech** students will be awarded master's degrees from KMITL, and will also receive certificates from the **TAIST Tokyo Tech** program. This certificate will be signed jointly by representatives of Tokyo Tech and NSTDA. The issue of joint degrees and certificates will be a matter of further discussion.
- Some Tokyo Tech students will be encouraged to study at **TAIST Tokyo Tech** for short terms.
- Personnel from industrial companies can request to participate in individual courses.

2-3. Faculty members and their duties

- The majority of courses will be taught by professors from Tokyo Tech with participation from Thai counterparts. Professors from Tokyo Tech may include retired professors or contract-based experts from specific industries. Tokyo Tech professors will also provide research cooperation on strategic topics.
- Tokyo Tech will dispatch professors for education and research using its own budget.
The expected duration of staying in Thailand will be as follows:

    Program chair: 2-3months;

     Professors for education & research: 10 persons/program, 2-3weeks/time;

     Professors for R&D: 1 week/time

- Most lecture courses will be taught in the form of intensive courses over a period of 2-3 weeks. These "face-to-face lectures" might be combined with distance education.
- Participation from other universities in Japan is most welcome. Possible candidates for participation are Tokyo University of Agriculture and Technology, Tokyo University of Marine Science and Technology, etc.

2-4. Others

- Researches at **TAIST Tokyo Tech** will base upon collaboration among Tokyo Tech, Thai universities and NSTDA and utilize mainly the human resources and facilities at NSTDA.
- Cooperation with various industries will be enhanced through activities at **TAIST Tokyo Tech** .
- The Thai government is initiating an Institution to serve as a central funding and coordinating body for projects similar and analogous to **TAIST Tokyo Tech** . After this has happened, the structure and affiliation of **TAIST Tokyo Tech** may be modified. .
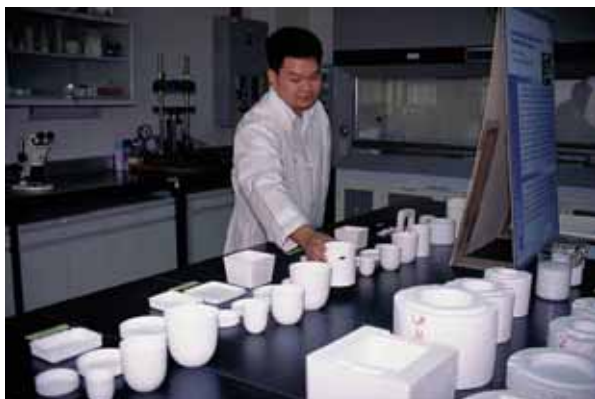
3. Programs

3-1. Programs planned to be launched

- Automotive Engineering (AE) (with KMITL)
- Information and Communication Technology (ICT)
- Bioscience and Biotechnology (BIO)
- Environmental Engineering (EnvE)

Environmental consideration will be essential to all of the advanced technological fields of AE, ICT and BIO in conducting researches and developing human resources for sustainable development in harmony with the environment. Fig.2 shows the structure of such synergy. According to the situation of the Thai industry and preparation by Tokyo Tech, the Automotive Engineering program and related Environmental Engineering courses will be the first ones launched.
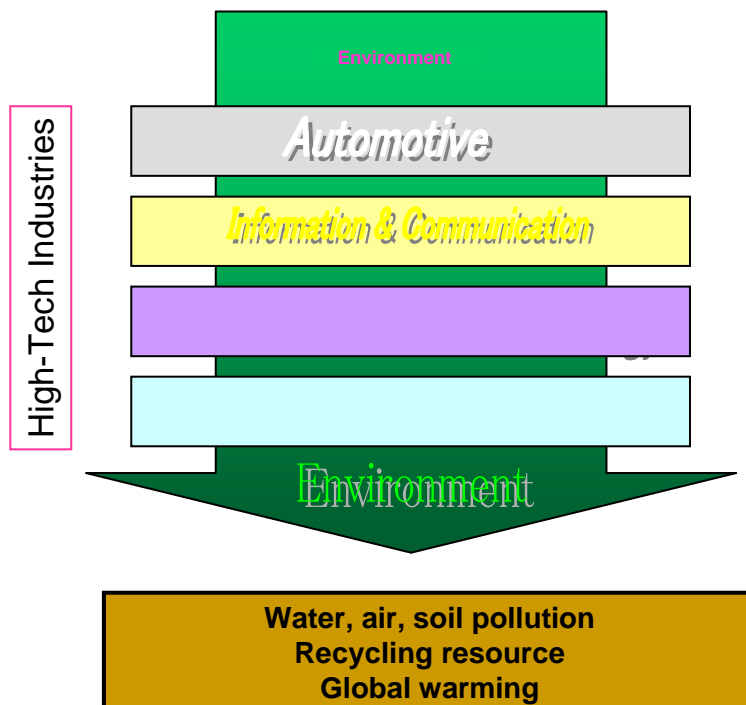

Fig.2 Program structure of TAIST Tokyo Tech

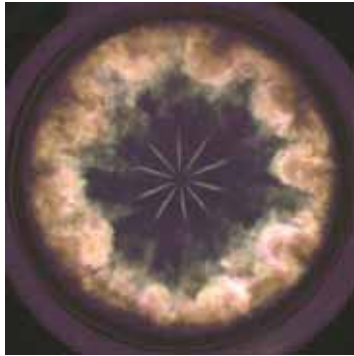## 3-2. Master of Engineering Program in Automotive Engineering

Prof. Ken Okazaki
Tokyo Tech.
Program Chair

In order to achieve an environmentally-friendly system of transportation in the next generation, a sophisticated automobile has to be developed and widely used throughout the entire world. From this background, the automotive industry requires trained engineers who have a global perspective, international exposure and knowledge of diverse topics. Taking the requirements of the automotive industry into account and considering the expansion that is taking place, the Master of Engineering Program in Automotive Engineering has been developed to create industry-ready engineers who have all the required qualities and have mastered more advanced concepts. The Automotive Engineering courses, which will mainly be conducted by professors from Tokyo Tech, will consist of a broad educating in engineering, incorporating fundamental aspects of automotive engineering, such as electric controls, aerodynamics, combustion and production, as well as exercise for automotive design.
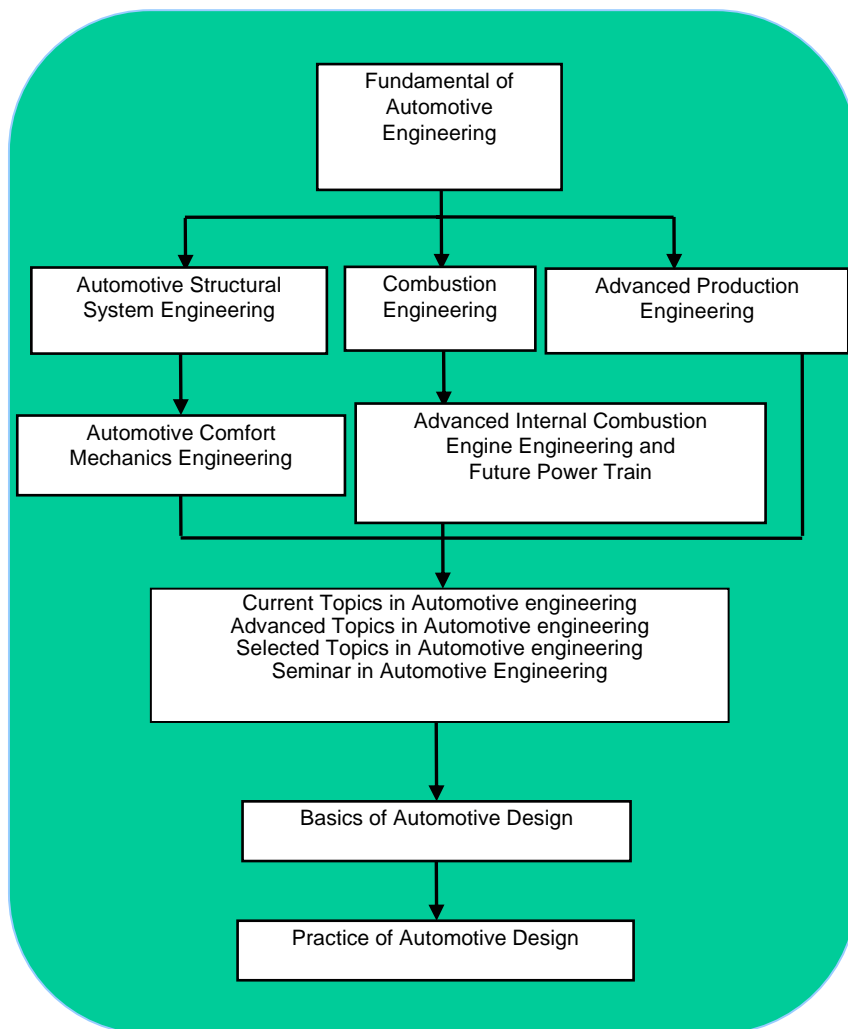
It is an opportunity for Thai (and international) students to establish an international career and profit from the outsourcing wave that is benefiting all sectors of the economy.
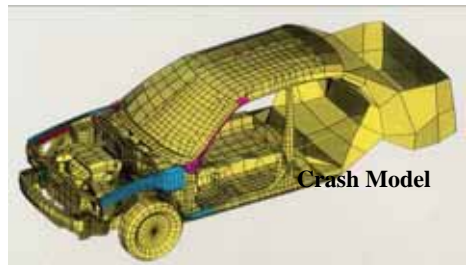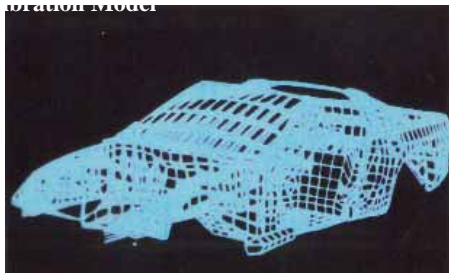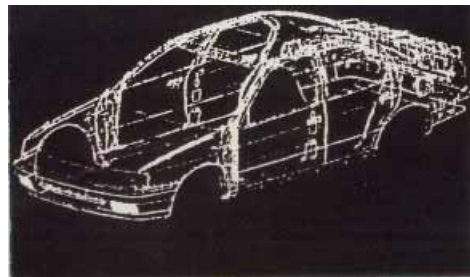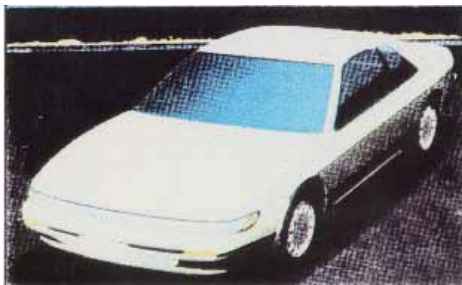
Revolution of Vehicle Development From Physical Model to Data Model

Diesel Combustion (Transient Spray Flame)

Curriculum-flow of Automotive Engineering Courses

4. Courses in Automotive Engineering Program at KMITL under TAIST Tokyo Tech

1. Automotive Structural System Engineering
3 (3-0-0) Credits

1.1.Overview on Vehicle Research and Development
(15 hours, T. Kitahara)

1.1.1 Vehicle Planning and Design
   (1) From Advanced Research to Marketing
   (2) The Past and the Future Prospect
1.1.2 Vehicle Components
   (1) Propulsion, Engine
   (2) Body and Suspension
1.1.3 Vehicle Characteristics
   (1) Performance of Man-Machine-Environment System
   (2) Active Safety and Passive Safety

1.2. Suspension and Drive-train Systems (15 hours, H. Morimura)

1.2.1 Suspension system
1.2.2 Steering System
1.2.3 Tire and its interaction with road surface
1.2.4 Braking System
1.2.5 Friction and tribology
1.2.6 Drive-train
1.2.7 Stability and maneuverability analysis
1.2.8 Advanced Control System

1.3 Mechanics of Thin-Walled Structures for Automobiles (15 hours, T. Adachi)

1.3.1 Concept of stiffness and strength for automotive structures
1.3.2 Fundamentals of solid mechanics
1.3.3 Deformations of tension, compression and torsion
1.3.4 Measurement of structural deformation
1.3.5 Theory of thin plates
1.3.6 Theory of monocoque structures
1.3.7 Theory of structural collision
1.3.8 Concept of impact energy Absorption

2. Automotive Comfort Mechanics Engineering
3 (3-0-0) Credits

2.1. Electronics and Control Engineering
(15 hours, M. Yamakita)

2.1.1 Introduction of electronics and control in automobiles
2.1.2 Electric control of engines and transmission
2.1.3 Electronics in operation monitoring

2.2. Aerodynamics and Air Conditioning
(15 hours, K.Hanamura)

2.2.1 Fundamentals of Fluid-Dynamics
2.2.2 Computational Fluid Dynamics (CFD)
2.2.3 Aerodynamics in Vehicles
2.2.4 Thermodynamics in Air-Conditioners
2.2.5 Air-Conditioning Systems in Vehicles

2.3. Vibration and Noise Engineering
(15 hours, M.Okuma)

2.3.1 Introduction of automotive vibration and noise problems
2.3.2 Measurement and data processing for vibration and noise
2.3.3 Modelling for vibration and noise analysis,and comfortability
2.3.4 Numerical simulation of vibration and noise
2.3.5 Structural design and technology for vibration noise reduction

3. Combustion Engineering   3 (3-0-0) Credits

3.1. Fundamentals of Combustion (15 hours, S. Hirai)
3.1.1 Reactive gas dynamics (laminar and turbulent flames)
3.1.2 Ignition and extinction
3.1.3 Reaction kinetics and simulation

3.2. Thermodynamics in Internal Combustion Engines
(15hours, H. Kosaka)

3.2.1 First and second laws of thermodynamics in internal combustion engines
3.2.2 Gas cycles of internal combustion engines
3.2.3 Thermodynamic analysis of heat release rate in internal combustion engines

3.3.Combustion Technologies in Internal Combustion Engines
15 hours, H. Kosaka or T. Kamimoto

3.3.1 Combustion technologies in spark ignitio engine
3.3.2 Combustion technologies in compressio ignition engine
3.3.3 Combustion technologies for high efficiency and clean exhaust gas

4. Advanced Internal Combustion Engine Engineering and Future Power Train 3 (3-0-0) Credits

4.1. Flow and Combustion Diagnostics in IC Engines
(15 hours, T. Kamimoto)

4.1.1 Flow diagnostics in IC engines
4.1.2 Combustion diagnostics in IC engines

4.2. Zero Emission Technologies (15 hours, K. Hanamura)
4.2.1 Production and control of Nox
4.2.2 Production and control of particulate matters
4.2.3 Advanced zero emission technologies

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4.3. Future Power Train for Sustainable Community (15 hours, K. Okazaki)

4.3.1 Energy consumption and environmental protection

-Present status in South-East Asia and World-

4.3.2 Future energy systems for sustainability

4.3.3 Present status and future prospect of sustainable mobility / Battery electrical vehicle, hybrid vehicle, fuel cell vehicle

5. Advanced Production Engineering

5.1. Fundamentals of Production Technology (15 hours, Y. Saito)

5.1.1 Production Processes for Automotive Engineering

5.1.2 Integrated and Intelligent Manufacturing System

5.1.3 Structure and Function of Machine Tool

5.1.4 Computer Numerical Control of Machine Tools

5.1.5 Practical Training of CAD/CAM and CNC Machine Tools

5.2. Welding and Joining (15 hours, K. Takahashi)

5.2.1 Physics and Basic Engineering in Welding and Joining

5.2.2 Welding and Joining processes

5.2.3 Equipments for Welding and Joining

5.2.4 Behaviour of Materials in Welding and Joining

5.2.5 Design and Construction of Joints

5.2.6 Analyses of Joints

5.2.7 Examples of Welding and Joining process

5.3. Quality Management and Production Planning (15 hours, M. Miyakawa)

5.3.1 Problem Solving Using SQC tools

5.3.2 Process Control

5.3.3 Quality Design by Experimental Study

5.3.4 Reliability Engineering

5.3.5 Scheduling Methods

5.3.6 Inventory Control

6. Basics of Automotive Design   3 (3-0-0) Credits

6.1 Basics of CAD (15 hours, I. Hagiwara)

6.1.1 Overview of CAD

6.1.2 Theory of Curved Line and Curved Surface

6.1.3 Theory of Mesh Generation

6.1.4 Theory of Reverse Engineering

6.2   Basics of CAE (15 hours, I. Kajiwara)

6.2.1 Overview of CAE

6.2.2 Technology for Analysis

   Finite Element Method, Boundary Element Method, Optimization Analysis, Control Engineering

6.2.3 Application examples

6.3 CAE Model (15 hours, H. Morimura, M. Okuma)

6.3.1 Generating CAE Model from CAD

6.3.2 Generating CAE Model from Measured DATA

6.3.3 Generating CAE Model from Experiments

6.3.4 Identification of CAE Model

7. Practice of Automotive Design   3 (2-1-0) Credits

7.1 Practice of Design (1) / Design of SAE-Formula Car (15 hours, H. Morimura, I. Hagiwara)

7.1.1 Planning of Vehicle

7.1.2 Harmonization of Performance and Components

7.1.3 Concept of Frame Structures

7.1.4 Analysis of Strength and Stiffness   with CAD/CAE

7.2 Practice of Design (2) / Analysis of SAE-Formula Car (15 hours, H. Morimura)

7.2.1 Tuning of Engine Performance and Gear ratio

7.2.2 Braking effort and Brake-lock

7.2.3 Performance of Circling Movements

7.2.4 Maneuverability

7.3 Assembly and Disassembly of Engine and Beam Model (15 hours, H. Morimura)

7.3.1 Disassembly of Engine and Measurement of Components

7.3.2 Assembly of Engine

7.3.3 Assembly of Miniature Beam Model for Frame Structure

7.3.4 Measurement of Beam Model

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5. Establishment of TAIST Tokyo Tech

- Sep. 2001: MOU between Tokyo Tech and NSTDA. The idea for a joint graduate institute was introduced including the idea of distribution of lectures via a satellite system.
- Oct. 2002: Tokyo Tech Office (Thailand) launched in NSTDA, TSP.
- Nov. 2005: Meeting between Dr. Aizawa, President of Tokyo Tech, and senior officials from NSTDA. Discussion was on feasibility of the establishment of a joint graduate institute.
- Apr. 2006: First visit by the AE group of Tokyo Tech to Thailand and preparation for an Automotive Engineering Conference.
- May 2006: Drafting of AE program and courses started by Tokyo Tech, NSTDA, KMITL and SIIT.
- Jul. 2006: Visit by the ICT group of Tokyo Tech to NSTDA.
- Jul. 2006: Workshop at Tokyo Tech by the BIO group.
- Aug. 2006: Automotive Engineering Conference at NSTDA.
- Nov. 2006: Forum on EnvE and ICT held at Tokyo Tech.
- Dec. 2006: Signing of "Sub-agreement of the Memorandum of Understanding on the Cooperation in the First Phase of a Joint Graduate Institute" by Tokyo Tech, NSTDA, KMITL and SIIT.
- Jan. 2007: Formal processes started by KMITL to seek approval for the AE program.
- Apr. 2007: Interview of potential students.
- Jun. 2007: Launching of **TAIST Tokyo Tech** and start of instructions.

6. Educational and Research Collaborations of Tokyo Tech with the Kingdom of Thailand

6-1. Partner Universities/Institutes

- Chulalongkorn University (Oct. 1985)
- King Mongkut's Institute of Technology Ladkrabang (Nov. 1992)
- Thammasat University (Mar. 1996)
- Kasetsart University (Dec. 1996)
- National Science and Technology Development Agency (Sep. 2001)
- King Mongkut's Institute of Technology North Bangkok (Jan 2005)
- Asian Institute of Technology (Dec. 2005)

6-2. Students from Thailand attending Tokyo Tech

FY	Total	Undergraduate	Master's	Doctoral	Non-Degree
2001	55	6	0	32	7
2002	48	6	7	27	8
2003	59	3	16	27	13
2004	52	1	16	26	9
2005	54	1	16	27	10
2006	57	3	19	29	6

6-3. Collaboration Projects

- UNESCO International Course for Advanced Research in Chemistry and Chemical Engineering (1965-2002)
- Support for the Faculty of Engineering, Thammasat University (1994-2000)
- Support for the Research Center of Communication and Information Technology, KMITL (1997-2001)
- JSPS-NRCT Core University Program in the field of Environmental Engineering (1999 -)
- MOU with NSTDA (2001 -)
- Distance Education Project (2002 -)
- Tokyo Tech Office (Thailand) (2002 -)
- Research Collaboration with NSTDA in the field of Solar Cell Technology (2003 -)
- Tokyo Tech UNESCO International Research Course for the Environment (2004 -)

**7. Corporate donation: Your support is vital to our project**

Tokyo Tech, NSTDA, KMITL and SIIT will jointly establish **TAIST Tokyo Tech**, which aims to promote and supply the following personnel to manufacturing in Thailand:

Engineers and researchers educated by the faculty members of Tokyo Tech, NSTDA and Thai universities.
Experts with a wide and global view.
Experts who contribute to development and solving problems in the region.

 TAIST Tokyo Tech will do the following activities for the company and the organization which support for the programs:

Consultation, support and problem solving by research and development.
Introduction of research laboratories in Thailand.
Construction of a new human network not only in Thailand but also in neighbouring countries.

 TAIST Tokyo Tech will create a lot of advantages for universities, research laboratories and also for the supporting companies and organizations.
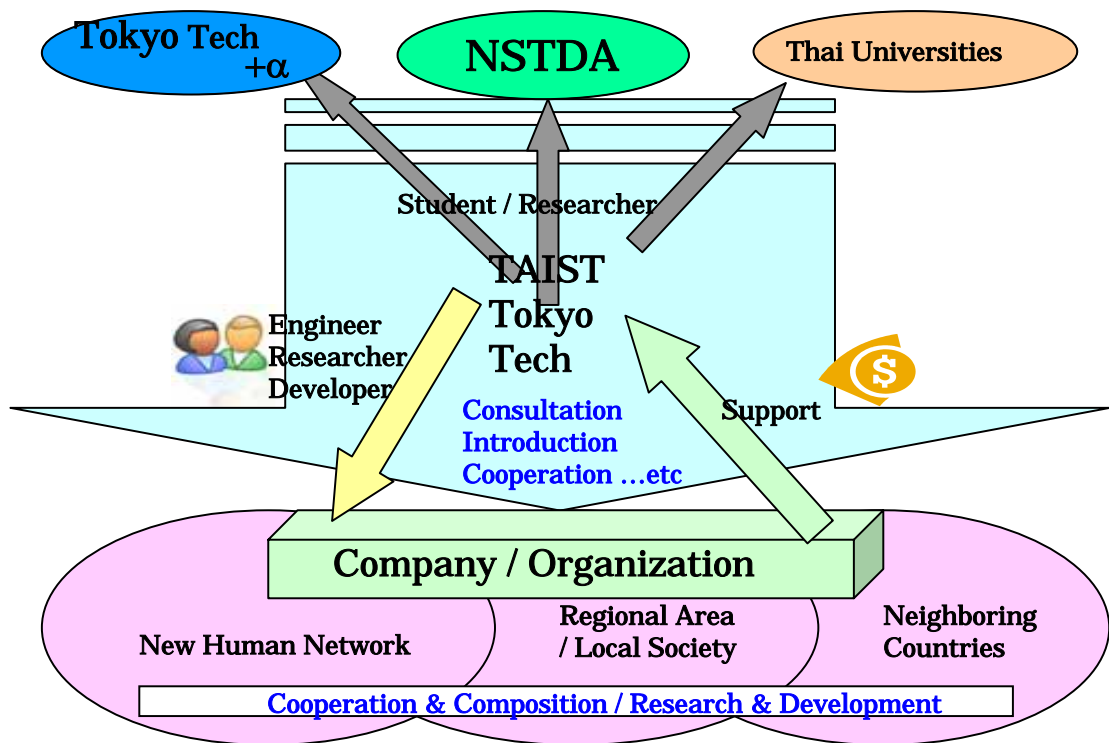
If you have any questions, requests or comments, please do not hesitate to contact us (please see the last page of this brochure).
Your kind offer to support **TAIST Tokyo Tech** would be highly appreciated.

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March, 2007