INSTITUT TEKNOLOGI BANDUNG

MASTER OF AUTOMOTIVE ENGINEERING

PROGRAM OF THE 1ST YEAR

Winter semester

Topics	Contact hours	Repartition L./E.	ECTS Credits
INTERNAL COMBUSTION ENGINES	104	4 + 4	8
AUTOMATION OF INDUSTRIAL EQUIPMENT	104	4 + 4	8
MECHANICAL VIBRATION	91	4 + 3	7
ADVANCED MECHANICS	91	4 + 3	7
			30

Summer semester

Topics	Contact hours	Repartition L./E.	ECTS Credits
ENGINEERING ANALYSIS	104	4 + 4	8
VEHICLE DYNAMICS	104	4 + 4	8
MULTIBODY MODELING OF VEHICLE SYSTEM	91	4 + 3	7
TRANSMISSION AND DRIVELINE	91	4 + 3	7
			30

INTERNAL COMBUSTION ENGINES

Type	Compulsory	**Semester**	winter
Contact hours 104		**Number of credits**	8
Type of termination	Exam	**Form**	Lectures + exercises

Lecturers

Assoc. Prof. Dr. Iman Kertolaksono Reksowardojo

Anotation

TARGET
The course is intended to provide basic proficiency to connect field experience and modules in class of fuel engine. Furthermore, student are expected to be able to come up with integrated solution based on all mechanical engineering knowledge to solve related to combustion engines problems.

CONTENTS
Briefly, the modules of this course are: Otto and Diesel cycle, effect of design and operation to performance and fuel usage, review about thermodynamic and fluid mechanic, combustion process, heat transfer, friction, power loss, the effect of power loss, efficiency, exhaust gas emission, operation characteristics of various fuel engine, and development tendency of Otto and Diesel engine.

Study materials

1. Heywood, J.B., *Internal Combustion Engine Fundamentals*, McGraw Hill, International Editions, New York, 1988
2. Pischinger, R., Krasnik G., Taucar G., Sams Th.; *Thermodynamik der Verbrennungskraftmasschine* ; Springer-Verlag; 1989; Band 5; ISBN 0-387-82105-8
3. Murayama, T., Tsunemoto, H., *Engineering of Automobile Engine*, Sankai -do, 1999, ISBN 4-381-10104-9

AUTOMATION OF INDUSTRIAL EQUIPMENT

Type	Compulsory	**Semester**	winter
Contact hours 104	**Number of credits**	8	
Type of termination	Exam	**Form**	Lectures + exercises

Lecturers

Prof. Mulyowidodo Kartidjo

Anotation

TARGET

The course has been designed to provide an extended overview and fundamental knowledge in the field of Industrial Automation, while building the necessary knowledge level for further specialization in advanced concepts of Industrial Automation. After completion of the course, the students shall have knowledge and understanding of:

1. The latch principle and ways of design logical automation diagrams
2. Synthesize automation systems by combining sensors, actuators and relays
3. Basic knowledge in PLC programming

CONTENTS

This course is the introductory course of automation system, mathematical model, partly automation, technology group, flexible manufacturing, PLC (programmable logic controller), CNC machinery, CNC programming.

Briefly, the modules of this course are:

1. Industrial automation, economical automation, mathematical model, storage, partly automation, balancing, group technology, and flexible manufacturing,
2. PLC, introduction of PLC, advantages of PLC, ladder logic diagrams, component of PLC, operation of PLC, PLC programming,
3. CNC machinery, general information of CNC machinery, operation, and function of spindle,
4. CNC programming, computer-aided programming, equipments for automation programming.

Study materials

1. Johnson, C. D., *Process Control Instrumentation Technology*, Prentice Hall, 2002.
2. Murril, P. W., *Fundamentals of Process Control Theory*, ISA, 2000.
3. Fraser, R. E., *Process Measurement and Control: Introduction to Sensors, Communication, Adjustment, and Control*, Prentice Hall, 2001.
4. Shinskey, F. G., *Process Control Systems: Application, Design, and Tuning*, McGraw Hill Professional, 1996.
5. Dunning, G., *Introduction to Programmable Logic Controllers*, Delmar Thomson Learning, 2002.
6. Morris S. B., *Programmable Logic Controllers*, Prentice Hall, 2000.

MECHANICAL VIBRATION

Type	Compulsory	**Semester**	winter
Contact hours	91	**Number of credits**	7
Type of termination	Exam	**Form**	Lectures + exercises

Lecturers

Prof. Dr. Zainal Abidin

Anotation

TARGET

This course lays the foundation in mechanical vibration by discussing the theory and some relevant engineering applications.

CONTENTS

The coverage includes classification of vibration, single degree of freedom (d.o.f.) undamped free vibration, damped vibration, single d.o.f. forced vibration, resonance, vibration sensors, transient vibration (Laplace transform), and two d.o.f vibration systems.

Study materials

1. Thomson, W. T., *Theory of Vibration with Applications*, Prentice Hall, 1993.
2. Dimarogonas, A. D., *Vibration for Engineers*, Prentice Hall, 1992.
3. Meirovitch, L., *Element of Vibration Analysis*, McGraw-Hill, 1986.

ADVANCED MECHANICS

Type	Compulsory	**Semester**	winter
Contact hours	91	**Number of credits**	7
Type of termination	Exam	**Form**	Lectures + exercises

Lecturers

Dr. Tatacipta Dirgantara

Anotation

TARGET

After completing this course, the students would be able to:

1. describe the concept of "stress at a point" (state of stress and strain in 3D)
2. analyze the transformation of stress and strain in 3D including the utilization of yield criteria
3. apply the knowledge to design the mechanical structures in the view point of both strength and deformation including the design by means of numerical simulation

CONTENTS

1. Fundamental Concept
2. Introduction to Cartesian Tensors
3. Two and Three Dimensional Theories of Stress and Strain (Method of Continuum Mechanics, Theory of Elasticity)
4. Generalized Hooke's Law (Linear Stress-Strain-Temperature)
5. Energy Principal in Solid Continuum
6. Application of Energy Methods
7. Inelastic Material Behavior
8. Theories of Failure
9. Application of Elasticity

Study materials

1. Boresi, A. P., Schmidt, R. J., and Sidebottom, O. M., *Advanced Mechanics of Materials*, 5th Edition, John Wiley & Sons, Inc., 1993
2. Lai, W. M., Rubin, D., and Krempl, E., *Introduction to Continuum Mechanics*, 3rd Edition, Pergamon Press, 1993

ENGINEERING ANALYSIS

Type	Compulsory	**Semester**	summer
Contact hours	104	**Number of credits**	8
Type of termination	Exam	**Form**	Lectures + exercises

Lecturers

Dr. Ing. Pulung Nuprasetio

Anotation

TARGET

1. To learn the relationships between engineering and mathematics
2. To learn how to derive mathematical (analytical) models for the solution of engineering problems
3. To learn how to formulate mathematical models, e.g. calculus and differential equations for mechanical engineering problems involving various sub-disciplines
4. To learn how to interpret mathematical solutions into engineering terms and senses

CONTENTS

1. Series and Fourier transformation
2. Partial differential equations,
3. Variable separation technique
4. Complex number function
5. Power series
6. Residual integration method
7. Unconstraint optimization
8. Probabilistic theory and statistics

Study materials

1. Kreyszig, E., *Advanced Engineering Mathematics*, 8th ed., Wiley,1999..
2. Rochim, T., *Spesifikasi, Metrologi, & Kontrol Kualitas Geometrik*, Penerbit ITB, 2001.
3. Hald, A., *Statistical Theory with Engineering Applications*, Wiley, 1952.

VEHICLE DYNAMICS

Type		Compulsory	**Semester**	summer	
Contact hours	104	**Number of credits**	8		
Type of termination		Exam	**Form**	Lectures + exercises	

Lecturers

Assoc. Prof. Dr. Ing. Pulung Nurprasetio

Anotation

TARGET

The course aims to provide fundamental knowledge of the dynamics of ground vehicles comprising propulsion/braking performance, handling and ride aspects. Any vehicle is considered to be a system, composed of modular components. The course will provide knowledge for predicting the vehicle response to various driver and environmental inputs.

CONTENTS

Briefly, the modules of this course are: Railway vehicles: contact between wheel and rail, sine motion, bogie, car structure, and connecting elements, primary and secondary suspensions, traction force, traction curve (traction force versus velocity diagram), rolling resistance, vibration. Automotive or ground vehicles: tire characteristics, ride and handling, performance, suspension design, transmission, body and structure design.

Study materials

1. Gillespie, T. D., *Fundamentals of Vehicle Dynamics*, SAE, 1992
2. Reimpell, J., and Stoll, H., *The Automotive Chassis: Engineering Principles*, SAE, 1996
3. Dixon, J.C., *The Shock Absorber Handbook*, SAE, 1999
4. Riley, R.Q., *Automobile Ride, Handling, and Suspension Design*, R.Q. Riley Enterprises, 1999

MULTIBODY MODELING OF VEHICLE SYSTEM

Type		Compulsory	**Semester**	summer	
Contact hours	91	**Number of credits**	7		
Type of termination		Exam	**Form**	Lectures+exercises	
Lecturers					

Prof. Andi Isra Mahyuddin

Anotation

TARGET

The objectives of this course are to provide the student with analytical and computer skills that will allow students to:

1. Design Multibody systems in two and three dimensions starting from scratch using sound theoretical principles and state of the art software.
2. Design of rigid body systems with applications to mechanisms and working assemblies in two and three dimensions.
3. Dynamic analysis models for kinematic (position, velocities accelerations) and kinetics (forces and moments).
4. Analyze forces and moments in two and three dimensions under impulsive impact forces and collisions.
5. Apply these techniques to vehicles and machinery.

CONTENTS

The topics of this course are as follows:

1. Fundamentals of Particle Mechanics, equations of motion.
2. Kinematics of Rigid Bodies Position Analysis, velocity and accelerations.
3. Rigid Bodies, Plane Motion, Linkages, and mechanisms in two dimensions.
4. Three dimensional models for dynamic analysis. (Software, SOLIDWORKS, NASTRAN4D).
5. Dynamic analysis of Rigid Multi-Body systems. Forces and moments in two and three-dimensional Mechanisms
6. Mechanics of deformable bodies.
7. Mutibody dynamic applications to ground vehicles.

Study materials

1. Shabana, A. A., *Dynamics of Multibody Systems 3rd Edition*,. Cambridge University Press, 2005
2. Farid M. L. Amirouche, *Fundamentals of Multibody Dynamics: Theory and Applications*, Prentice Hall, 2006
3. Leonard Meirovitch, *Methods of Analytical Dynamics*, Dover Publication Inc., 1998
4. Beer, F., and Johnston, E. R., *Vector Mechanics for Engineers- Dynamics*, 7th Ed., McGraw Hill, 2004
5. Uicker, Pennock, Shigley, *Theory of Machines and Mechanisms*, Oxford University Press, 2003

TRANSMISSION AND DRIVELINE

Type	Compulsory	**Semester**	summer
Contact hours	91	**Number of credits**	7
Type of termination	Exam	**Form**	Lectures+exercises

Lecturers

Prof. Indra Nurhadi

Anotation

TARGET

This course offers an efficient way of up-skilling students in the rapidly growing area of automotive transmission engineering. On completion of the full course programme delegates should have a comprehensive understanding of the technology and be able to make a significant contribution to design and development teams working in the automotive sector.

CONTENTS

The course will cover:

1. **Transmission Categories**: Manual and Automatics, Production and Trends
2. **Typical Construction and Operation of Transmissions**: Manual and Automated Manuals, Automatic Transmissions, Dual Clutch Transmissions, Continuously Variable Transmissions and Split Path Operation
3. **Torque Converters**: Operation and Matching Synchronisers
4. **Gearing Basics**: Geometry, Conjugate Motion, Noise, Rattle, Error, Backlash And Module
5. **Gear Loading and Life**: Reaction Loads, Parallel and Bevel, Failure Modes, Bending, Contact Fatigue, Wear, Scoring And Micropitting
6. **Clutch Operation**: Thermal and Torque Calculations for Wet and Dry
7. **Shafts**: Torsion, Bending and Deflection
8. **Splines**: Capacity, Classification, Fit and Backlash
9. **Final Drive Units**: Open, Passive and Active
10. **Tribology**: Hertzian Contact and Stress, Lubrication Regimes, Friction and Stribeck
11. **Transmission Control**: Automatic and CVT Control.

Study materials

1. U. Kiencke and L. Nielsen, *Automotive Control Systems: For Engine, Driveline, and Vehicle, 2nd Edition*, Springer-Verlag New York, LLC, 2010.
2. *Integrated Powertrain and Driveline Systems 2006 (IPDS 2006)*, CRC Press, July 2006.