Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Theory of Gearing and its Applications	Credits	3
		Hours	3
Instructor's Name	Dr. Chung-Biau Tsay		
Course Objective	This course offers the graduate students to facilitate the modern theory of gearing, and then students can apply the theory to the profile design, contact simulation and transmission analysis of the conjugate kinematic pairs, such as gears, cams, pumps, etc.. The course also promotes the students to understand the characteristics of the conjugate kinematic pair, and enables students to perform the related research problems.		
Text Book	Faydor L. Litvin, "Gear Geometry and Applied Theory", Prentice Hall, 1994.		
Reference Books	1. Faydor L. Litvin, "Theory of Gearing", NASA Reference Publication 1212, Washington D. C., 1989. 2. Faydor L. Litvin, and Alfonso Fuentes, "Gear Geometry and Applied Theory", Cambridge University Press UK, 2004.		

Course Contents

1. Course introduction, contents review
2. Chapter1. Coordinate Transformation.
3. Chapter1. Coordinate Transformation.
4. Chapter2. Transformation of Motion.
5. Chapter2. Transformation of Motion.
6. Chapter3. Planar Curves.
7. Chapter3. Planar Curves.
8. Midterm Exam
9. Chapter4. Conjugate Shapes.
10. Chapter4. Conjugate Shapes.
11. Chapter5. Gearing Analysis (Tooth Contact Analysis.)
12. Chapter5. Gearing Analysis (Tooth Contact Analysis.)
13. Project study: Gear Design and Analysis
14. Chapter6. Basic Kinematic Relations of Gearing and Their Applications.
15. Chapter6. Basic Kinematic Relations of Gearing and Their Applications.
16. Chapter6. Basic Kinematic Relations of Gearing and Their Applications.
17. Chapter7. Generation of Conjugate Shapes.
18. Final Exam

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Advanced Kinematics	Credits	3
		Hours	3
Instructor's Name	Dr. Fu-Hua Jen		
Course Objective	Instruct students to learn knowledge in advanced kinematics. It includes kinematics synthesis, kinematics analysis,		
Text Book			
Reference Books	1 A.G. Erdman, Modern Kinematics, Wiley, 1993. 2 R.S. Hartenberg and J. Denavit, Kinematic Synthesis of Linkages,		

Course Contents

1. First example for design of mechanism
2. Introduction to mechanical device
3. Synthesis of linkage for multiple positions
4. Analytical synthesis
5. Analysis of kinematics
6. Techniques for creative design
7. Design methodology
8. Generalizations of joints and links
9. Generalizations of mechanical chain
10. Kinematic chains
11. Specializations for mechanism
12. Topics

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	System Vibration	Credits	3
		Hours	3
Instructor's Name	Dr. Hsing-Hsin Huang		
Course Objective	The purpose of this course is to study the subject of mechanical and structural vibration. Both the responses of free and forced vibration are discussed. The introduction starts from one degree of freedom system to complicated continuous models. Several measurement instruments and analysis software are also introduced to help students to gain more understanding of the concept of this course.		
Text Book	"Mechanical Vibration analysis, uncertainties, and control", Haym Benaroya, Prentice Hall, ISBN 0-13-948373-X		
Reference Books	Technical Documentations of Bruel & Kjaer.		

Course Contents

1. Introduction and Background
2. Mathematics & Software
3. Undamped Single DOF Vibration: Examples and Mathematical Modeling, Free Vibration w/o Damping, Harmonic Forced Vibration w/o Damping
4. Damped Single DOF Vibration: Free Vibration w/h Damping, Harmonic Excitation and Damped Response, Examples
5. Single DOF Vibration: Experiments and Signal Analysis
6. State Variable Method and Simulation
7. Principle of Virtual Work and Lagrange's Equation
8. Multi DOF Vibration: Examples and Derivation of Equation of Motion, Undamped Vibration and Forced Vibration by the Direct Method, Modal Analysis
9. Multi DOF Vibration: Experiments and Signal Analysis
10. Continuous Models for Vibration: Vibration of Strings, Shafts and Beams

Minghsin University of Science and Technology
Syllabus for Elective Courses

Course Title	Image Inspection Technology	Credits	3
		Hours	3
Instructor's Name	Dr. Mu-Jung Chen		
Course Objective	The main objectives of this course are to provide students with principles of optical inspection, digital image processing, hardware and program of image inspection, image inspection technology, and applications in industry automation.		

Course Contents

1. Basic device and equipment of image inspection system
2. CCD camera and geometrical optics
3. Basic technologies of image processing, and program library
4. Image filtering
5. Image enhancement
6. Image calibration
7. Frequency domain analysis
8. Particle measurements
9. Edge detection and auto focus
10. Pattern identification
11. Dimensional measurements
12. Shape measurements
13. Defect inspection
14. Applications of image inspection technology
15. Case study of image inspection technology

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Advanced Computer-Aided Design	Credits	3
		Hours	3
Instructor's Name	Dr. Ming-Jong Wang		
Course Objective	Teach students how to design machine elements, assembly the designed parts, and the dynamic simulation of assembled mechanism by using CAD software.		
Text Book	Engineering Design and Graphics with Autodesk Inventor 2009 ISBN: 0-13-515762-5, James D. Bethune, Boston University, Autodesk, Autodesk, Inc.		
Reference Books			

Course Contents

1. Introduction to CAD
2. Create a 2-D sketch
3. Three dimensional model
4. The design process
5. Assemblies
6. Explosive view & its animation
7. Mechanism animation
8. Design projects

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Laser Technology and Application	Credits	3
		Hours	3
Instructor's Name	Dr. Chi-nan Wang		
Course Objective	This course introduces the basics and principles of laser material processing. Students will learn the laser technologies and its applications.		
Text Book	Handouts		
Reference Books	Laser Material Processing, William M. Steen Understanding Lasers-An Entry-Level Guide, Jeff Hetch		

Course Contents

1. Introduction to Laser
2. Laser Modes and Properties
3. Laser Safety
4. Mechanisms of Laser Material Processing
5. Industrial Lasers
6. Applications of Laser
7. Characteristic of Laser System

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Computer I/O Interface Control	Credits	3
		Hours	3
Instructor's Name	Mowcheng Lee		
Course Objective	To teach students computer IO and their interface control		
TextBook	Class handout		
Reference Books	http://www.google.com		

Class 1. Introduction to PC Architecture and Visual Basic
Class 2. Parallel port IO Interface--- part 1
Class 3. Parallel port IO Interface--- part 2
Class 4. Serial port IO Interface --- part 1
Class 5. Serial port IO Interface --- part 2
Class 6. Programmable interface 8255A and basic IO
Class 7. 8255A hand shake transmission
Midterm Examine
Class 8. 8253/8254 chips and counters
Class 9. D/A and A/D
Class 10. Step motor
Class 11. LCD
Class 12. USB
Class 13. Project and Discusion
Class 14. Project and Discusion
Class 15. Project and Discusion
Class 16. Project and Discusion
Final Examine

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Linear System	Credits	3
		Hours	3
Instructor's Name	Dr. Hsing-Hsin Huang		
Course Objective	Linear system is the basis of modern control. This class introduces the concept of a linear system, and discusses the I/O relation as well as the state information within a system The class also teaches MATLB and LABVIEW software to help students to understand the industrial control technology.		

Course Contents

1. Introduction
2. Mathematical background of a linear system
3. Introduction of MATLAB
4. I/O description and state variable description of a system
5. Dynamic analysis of a linear system
6. Introduction of Labview
7. Stability, Observability and Controllability
8. State feedback controllers and estimators design

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Laser metrology	Credits	3
		Hours	3
Instructor's Name	Dr. Mu-Jung Chen		
Course Objective	The main objectives of this course are to provide students with principles of laser metrology, laser interferometers, laser measurement systems, fiber laser measurements, laser signal processing and applications.		

Course Contents

1. Introduction to Laser metrology
2. Fundamental optics and optical components
3. Laser measurement system
4. Laser sources, modulation and photo detectors
5. Interference, diffraction, polarization and filtering
6. Single/dual frequency laser interferometers
7. Laser Doppler measurement
8. Laser triangulation method
9. Laser optical scales and grating techniques
10. Laser holography
11. Laser scanners and position sensitive detectors
12. Fiber laser measurements
13. Applications for precision machinery
14. Computerized optical signal processing
15. Case study

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Optimal Design	Credits	3
		Hours	3
Instructor's Name	Dr. Jie-Ren Shie		
Course Objective	This course focuses on training students about how to design experiments and analyze data through the design of experiment approach so that they can optimize the process parameters and design through optimization schemes.		
Text Book	Design and Analysis of Experiments 6/E		
Reference Books	None		

Course Contents

Topics	Abstract	Classes
Introduction	Basic of DOE	3
One Factor DOE	1. One factor design 2. Case study 3. Computer excises	9
Multiple Factor DOE	1. Multiple factor design 2. Case study 3. Computer excises	9
Multiple Factor with Multiple Level DOE	1. Multiple factor with multiple level design 2. Case study 3. Computer excises	9
Case Studies	1. Case study (1) 2. Computer excise (1) 3. Case study (2) 4. Computer excise (2)	6
Response Surface Method (RSM)	1. Introduction to RSM 2. Case study 3. Computer excises	9
Mixture Design	1. Introduction to mixture design 2. Case study 3. Computer excises	6
Mixture with Process Design Method	1.Introduction to mixture with process design method 2. Case study 3. Computer excises	3

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Practice of Mechatronic System	Credits	3
		Hours	3
Instructor's Name	Dr. Jen-Chao Tai		
Course Objective	1. To be acquainted with the basic components of mechanical device 2. To be acquainted with the basic components of electronic device 3. To be acquainted with the Programmable Logic Controller 3. To be acquainted with the practice of mechatronic system		

Course Contents

1. Introduction of the basic components of mechanical device
2. Introduction of the basic components of electronic/electrical device
3. Introduction of the basic components of pneumatic/hydraulic device
4. Introduction of the basic components of sensor device
5. Programmable logic controller and its application
6. Practice of vibrator feeding and quality inspection machine
7. Practice of automatic filling and Titration machine
8. Practice of pose inspection and assembly machines.
9. Practice of color identification and stacking machine
10. Practice of automatic storage and retrieval system

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Precision Machine Design(II)	Credits	3
		Hours	3
Instructor's Name	Dr. Jen-Chang Lin		
Course Objective	Concept of Design for machine elements in the machine		
Text Book	Mechanical Design An Integrated Approach by Ansel C. Ugural		
Reference Books			

Course Contents

1. Bearing and Lubrication
2. Spur Gears.
3. Helical,Bevel,Worm Gears.
4. Belt, Chain, Clutch, Brakes
5. Design of Springs
6. Power Screws, Fasteners, and Connections
7. Design of Micro-Machines
8. Design of Competitive Robot

Minghsin University of Science and Technology
Syllabus for Elective Courses

Course Title	Computer-Aided Engineering－Case Study	Credits	3
		Hours	3
Instructor's Name	Dr. Hung-Yu Lu		
Course Objective	Enforce the abilities of research and engineering analysis through the case study of computer-aided engineering.		
Text Book	Handout posted in e-Campus (Minghsin e-learning system)		
Reference Books	1. Finite Element Analysis, Theory and Application with ANSYS /Saeed Moaveni 2. Engineering analysis with ANSYS software / Y. Nakasone and S. Yoshimoto ; T.A. Stolarski. 3. The finite element method and applications in engineering using ANSYS / by Erdogan Madenci, Ibrahim Guven.		

Course Contents

1. Introduction to APDL.(ANSYS Parametric Design Program)
2. Theory of Dynamic Analysis
3. Introduction to Modal Analysis.
4. Case study: Modal analysis of Frames and Wings.
5. Introduction to optimization analysis
6. Case study: Optimization design of Beams and Wrenches.
7. Introduction to Nonlinear Analysis and Newton-Raphson Scheme.
8. Case Study: Nonlinear analysis of curved beams.
9. Case study: Structural analysis of beams under dynamic loading.
10. Case study: Bi-metal thermo-structure coupled analysis.
11. Case study: Thermal analysis of Chip-Scale package.

Minghsin University of Science and Technology
Syllabus for Elective Courses

Course Title	Finite Element Method	Credits	3
		Hours	3
Instructor's Name	Dr. Hung-Yu Lu		
Course Objective	1. Understand the theory and concept of finite element. 2. Practice various engineering problems by using ANSYS 3. Increase research ability and career compatibility.		

Course Contents

1. Introduction:
   Engineering Problems; 2.Numerical Methods; Basic Steps in the Finite Element Method; Finite Element Formulations: (1) Direct Formulation; (2) Minimum Total Potential Energy Formulation; (3) Weighted Residual Formulations.

2. Trusses:
   Definition of a Truss; Finite Element Formulation;
   Examples using ANSYS: Plane Trusses, Space Trusses

3. One-Dimensional Elements:
   Linear Elements, Quadric Elements, Cubic Element, Global, Local and Natural Coordinates, Numerical Integration: Gauss Legendre Quadrature.

4. Analysis of One-Dimensional Problems:
   Heat Transfer Problems, Truss Analysis, Beam and Frame Analysis, Analysis Examples of using ANSYS.

5. Two-Dimensional Elements:
   Rectangular Elements, Quadratic Quadrilateral Elements, Linear Triangular Elements.

6. Analysis of Two-Dimensional Problems:
   Heat Transfer Problems, Plane Stress Problems, Heat Sink and Plane Stress Problems using ANSYS.

7. Analysis of Three-Dimensional Problems:
   Thermal and Structural Example using ANSYS.

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Advanced Quality Control	Credits	3
		Hours	3
Instructor's Name	Dr. Jie-Ren Shie		
Course Objective	1. Educate students to implement DMAIC (Define Measure Analyze Improve Control) Six Sigma methodology from General Electric Co. (GE) to efficiently resolve quality related issues. 2. Train students to improve processes or designs through analyzing collected data.		

Course Contents

1. Introduction to six sigma quality control

2. Define phase:
   a) project definition; b) Process map; c)Grantt chart; d) presentation skills; e) define phase report

3. Measurement phase:
   a) Fishbone; b) Failure Mode and Effect Analysis; c) Pareto chart; d) Quality Functional Deployment; e) Measurement System Analysis

4. Analyze phase:

   a) Capability indices; b) Benchmarking; c) Hypothesis tests

5. Improve phase:
   a) Introduction to Design of Experiments; b) Variety of process maps; d) Introduction to Design for Six Sigma

6) Control phase:

   a) Gage study; b) Risk analysis; c). Mistake proof; d) Statistical process control and control charts

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Practice of Computer Control System	Credits	3
		Hours	3
Instructor's Name	Dr. Jen-Chao Tai		
Course Objective	1. To be acquainted with the basic actuators of control devices 2. To be acquainted with the basic devices of sensors 3. To use PC or micro-controller to control the industrial equipment		

Course Contents

1. Introduction of computer control system
2. Introduction of single chip 8051
3. Digital input, digital output and sequential control
4. Led matrix and key control
5. timer and led matrix control
6. Serial communication and PC program
7. PLC sequential communication and PC program
8. PC peripheral interface and program
9. Introduction of PIC
10. Registers of PIC
11. Timer application of PIC
12. AD conversion and DA conversion
13. PWM output
14. LCD control
15. Serial and parallel communication
16. I2C serial communication

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Modern Control Methods	Credits	3
		Hours	3
Instructor's Name	Dr. Hsin-Te Liao		
Course Objective	To introduce methods for analysis of feedback control system characteristics, including performance and stability, and design of feedback control		
Text Book	"Modern Control Systems", Richard C. Dorf & Robert H. Bishop		

Course Contents

1. Introduction; Dynamic System Modeling
2. Block Diagram and Transfer Function
3. State Variable Models
4. Control System Characteristics
5. Measures of Performance
6. Stability: Routh – Hurwitz method
7. Root Locus Method
8. Frequency Response: Bode Diagrams
9. Stability: Nyquist Criterion
10. Design of Compensators
11. Controllability and Observability

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Management of Technology	Credits	3
		Hours	3
Instructor's Name	Hansen T. Lee		
Course Objective	1. To integrate strategy and technology that today’ s business required that is applicable to no matter what the educational background of the student may be. 2. To provide insight into the management of technology and innovation that will be useful to students as they enter practices.		
Text Book	“The Management of Technology and Innovation”, Margaret A. White / Garry D. Bruton, ISBN：0-324-35365-0		

Course Contents

Chapter1. Management of Technology and Innovation

Chapter2. Strategy and Management of Technology and innovation.

Chapter3. Innovation ：Planning

Chapter4. Internal Innovation：Implementation

Chapter5. Innovation：Evaluation and Control

Chapter6. Obtaining Technology：Planning

Chapter7. Obtaining Technology：Implementation

Chapter8. Obtaining Technology：Evaluation and Control

Chapter9. Building Capability：For MTI success

Chapter10. Organizational Learning and Knowledge Management

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Power Electronics Control System	Credits	3
		Hours	3
Instructor's Name	Ming-Fa Tsai		
Course Objective	In this course, the materials about the controller and ASIC design of power electronic systems, such as buck and boost DC-DC converters, by using FPGA device and VHDL programming language are taught to the students with the help of MATLAB/Simulink simulation tool.		
Text Book	"Fundamentals of Power Electronics (2nd Edition)", Robert W. Erickson and Dragan Maksimovic, ISBN：0-324-35365-0		

Course Contents

1. The Principle of Buck DC-DC Converter.
2. Small-Signal Modeling of Buck Converter
3. Controller Design of Buck Converter
4. The Controller Circuit Design of the Buck Converter using VHDL
5. Simulation Verification of the Buck Controller Circuit Design
6. Small-Signal Modeling of Boost Converter
7. Controller Design of Boost Converter
8. The Controller Circuit Design of the Boost Converter using VHDL
9. Simulation Verification of the Boost Controller Circuit Design
10. The D/A Interface Circuit Design using VHDL
11. The A/D Interface Circuit Design using VHDL
12. FPGA Download Test of the Controller Design

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Power Electronics Control System	Credits	3
		Hours	3
Instructor's Name	Ming-Fa Tsai		
Course Objective	In this course, the materials about the controller and ASIC design of power electronic systems, such as buck and boost DC-DC converters, by using FPGA device and VHDL programming language are taught to the students with the help of MATLAB/Simulink simulation tool.		
Text Book	"Fundamentals of Power Electronics (2nd Edition)", Robert W. Erickson and Dragan Maksimovic, ISBN：0-324-35365-0		

Course Contents

1. The Principle of Buck DC-DC Converter.
2. Small-Signal Modeling of Buck Converter
3. Controller Design of Buck Converter
4. The Controller Circuit Design of the Buck Converter using VHDL
5. Simulation Verification of the Buck Controller Circuit Design
6. Small-Signal Modeling of Boost Converter
7. Controller Design of Boost Converter
8. The Controller Circuit Design of the Boost Converter using VHDL
9. Simulation Verification of the Boost Controller Circuit Design
10. The D/A Interface Circuit Design using VHDL
11. The A/D Interface Circuit Design using VHDL
12. FPGA Download Test of the Controller Design

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	System Reliability Analysis	Credits	3
		Hours	3
Instructor's Name	Dr. Jie-Ren Shie		
Course Objective	Teach students how to conduct reliability analysis from system level points of view		
Text Book	N/A		

Course Contents

Topics	Abstract	Hours
Introduction	Introduction to reliability engineering	6
FMEA and Applications of FMEA	1. Overview of FMEA 2. Applications and examples of FMEA	6
Theory and Mathematics of Reliability Engineering	1. Overview of probability 2. Distributions 3. Reliability related functions 4. Reliability life	9
Relex software practices	1. Basic of Relex 2. I/O and format of Relex files 3. Example	9
Reliability Block Diagram	1. Overview of RBD 2. Example of RBD	6
Relex software practices of RBD applications	RBD excises	6
Fault Tree and Event Tree	1. Overview of FT and ET 2. Example of FT and ET	3
Weibull Analysis	1. Overview of Weibull analysis 2. Examples and excises	9

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Special Topics of Semiconductor Technology	Credits	3
		Hours	3
Instructor's Name	Dr. Chin -An Wang		
Course Objective	1. Introduction to semiconductor materials. 2. Introduction to semiconductor fabrication processes 3. Applications of semiconductor technology		
Text Book	N/A		

Course Contents

1. Introduction to semiconductor material
2. Properties of semiconductors
3. Fabrication processes of semiconductors
4. applications of semiconductor technology

Minghsin University of Science and Technology

Syllabus for Elective Courses

Course Title	Introduction to Robotics	Credits	3
		Hours	3
Instructor's Name	Dr. JEN, FU-HUA		
Course Objective	Instruct students into robotic field with interests. Both practice and theory are studied in class. Let students learn the technology and trend of robotics.		
Text Book	to be assigned		

Course Contents

1. Requirements for mechatronics
2. Homogeneous transformation matrix
3. Coordinate transformation for robotics
4. Robot dynamics
5. Practice of industrial robot, I
6. Practice of industrial robot, II
7. Automation design of robots
8. Applications of sensors
9. Practice of intelligent robot, I
10. Path planning
11. Practice of intelligent robot, II
12. Applications of machine vision
13. Practice of intelligent robot, III
14. Bipedal robot
15. Topics of society with robots