**无损检测教学大纲**

SJQU-QR-JW-033（A0）

**【Non-Destructive Testing Methods】**

1. **Basic Information**

Course Number：2080428

Credit**：**【4】

Applicable Subject：【Mechanical Engineering】

Course Nature:【Department Core Course】

College: Mechanical and Electronic Engineering

**Textbook References:**

1. Thomas Lüthi，Non-Destructive Evaluation Methods，2014】
2. Mohammed Omar, Nondestructive Testing Methods and New Applications, InTech, 2012
3. 刘福顺，《无损检测基础》，北京航空航天大学出版社，2002

**Pre-requisite：**AutoCad, Engineering Mechanics, Engineering Materials and Forming Technologies

1. **Course Description**

【Non-Destructive Testing】is an important professional compulsory course for the students of Mechanical Design, Manufacturing and Automation. It is of strong theoretical and practical significance. It has a wide range of applications in engineering technology. It is a combination of total quality management science and non-destructive testing technology. This course contains five general non-destructive testing methods (visual inspection, liquid penetrant testing, magnetic particle testing, ultrasonic testing, and radiographic testing) and covers the detection principle, equipment and application, etc. The students' logical thinking ability and engineering application ability will be developed through theoretical lecturing combined with experimental practices. At the end, the students are expected to be able (i) to understand the basic principles, techniques, equipment, applications and limitations of NDT methods; (ii) to select appropriate NDT methods correctly; (iii) to identify the defects and flaws in materials; (iv) to make aware the developments and future trends in NDT. The quality level of the workpiece, quality analysis, material processing technology, and thus improve product quality, to lay a certain foundation for students to carry out testing related work and scientific research.

1. **Course Selection Advice**

Non-Destructive Testing Methods is an examination course for mechatronics students. It requires basic knowledge of AutoCAD, Engineering Mechanics, Engineering Materials and Forming Technologies.

1. **Course Content**

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| **Unit** | **Contents of Knowledge** |
| 1. Introduction /History

NDT Methods (4 hours) | * What is NDT?
* Historical development of NDT
* The birth of Codes and Standards
* NDT Qualification and Certification
* Basic overview of NDT methods
 |
| 1. Visual Inspection (VT) (4 hours)
 | * Advantages and Limitations of VT
* VT Qualification and Certification
* Direct and Indirect VT
* Discontinuities in manufacturing processes (e.g. welding)
* Performing VT
 |
| 1. Liquid Penetrant

Testing (PT) (4 hours) | * Basic steps of PT
* Mechanisms of PT
* Types of penetrants, removers, and developers
* Performing PT
 |
| 1. Magnetic Particle

Testing (MT) (4 hours) | * Basic principles of MT
* Four steps of MT
* MT equipment and media
* Performing MT
 |
| 1. Radiographic

Testing (RT) (6 hours) | * Types of RT sources
* Radiation
* RT equipment
* RT Safety
* Producing a radiograph
* RT image quality
* RT discontinuities
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| 1. Ultrasonic Testing (6 hours)
 | * Principles of sound
* UT equipment
* UT measurements and flaw detection
* UT calibration
* Data scan presentation methods
* Phased array UT
* Alloy identification
 |
| 1. Eddy Current Testing (ECT) (4 hours)
 | * Principle, physics aspects of ECT
* Field factor and list of effects, e.g. edge, impedance plane diagram, depth of penetration of ECT, relation between frequency and depth of penetration in ECT
* Equipments and accessories, various application of ECT
* Coating thickness measurement, advantages and limitations of eddy current testing
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1. **Experiments and Basic Requirements**

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| --- | --- | --- | --- | --- |
| **Item** | **Name of Experiment** | **Contents** | **Hours** | **Type of experiment** |
| 1 | Liquid penetrant test (LPT) | 1. Understand the LPT’s procedures
2. Perform LPT
 | 6 | Verification |
| 2 | Magnetic particle test (MPT) | 1. Understand the MPT’s procedures
2. Perform MPT
 | 6 | Verification |
| 3 | Radiographic test (RT) | 1. Radiographic Procedures
2. Image Production and Evaluation
3. Radiation Protection
4. Equipment Operation and Quality Control
5. Reporting
 | 10 | Comprehensive |
| 4 | Ultrasonic test(UT) | 1. UT equipment and calibration
2. Materials and surface preparation
3. Testing procedure
4. Defect evaluation and sizing
5. Reporting
 | 10 | Comprehensive |

**6 . Assessment**

|  |  |  |
| --- | --- | --- |
| **Marks（1+X）** | **Assessment** | **Weightage** |
| 1 | Final exam (50%) | 50% |
| X1 | Participation for the lectures 10% | 10% |
| X2 | Homework  | 10% |
| X3 | Experiment and report  | 20% |
| X4 | Mid-term exam | 10% |

**7. Teaching Schedule**

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| --- | --- | --- |
| **Calendar week** | **Teaching content** | **Teaching method** |
| 1 | Introduction /History | Lecture |
| 2 | NDT Methods  | Lecture |
| 3 | Visual Inspection (VT)  | Lecture |
| 4 | Liquid Penetrant Testing (PT) | Lecture |
| 5 | Magnetic Particle Testing (MT)  | Lecture |
| 6 | Radiographic Testing (RT) & Ultrasonic Testing | Lecture |
| 7 | Ultrasonic Testing | Lecture |
| 8 | Eddy Current Testing | Lecture |
| 9 | Liquid penetrant test (LPT) | Experiment |
| 10 | Liquid penetrant test (LPT)& Magnetic particle test (MPT) | Experiment  |
| 11 | Magnetic particle test (MPT) | Experiment  |
| 12 | Radiographic test (RT) | Experiment  |
| 13 | Radiographic test (RT) & Ultrasonic test(UT) | Experiment  |
| 14 | Ultrasonic test(UT) | Experiment  |
| 15 | Ultrasonic test(UT) | Experiment  |
| 16 | Ultrasonic test(UT) | Experiment  |
| 17 |  |  |
| 18 | Exam | Examination |

Prepared: Qinghua Hu Approved: Head of Department: 