

NDT skills and education needs in Asia

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Abstract: Non-Destructive Testing (NDT) plays a pivotal role in ensuring the safety and integrity of critical infrastructure across various industries. As technological advancements continue to reshape the landscape of NDT, it becomes imperative to examine the trends in NDT education at universities and higher learning institutions in the Asian region. This abstract provides a comprehensive overview of the key findings from an extensive research study conducted to analyze the current state of NDT education in Asia. The study encompasses a thorough review of NDT curricula, teaching methodologies, and practical training approaches employed by universities and higher learning institutions across Asia. It also explores the integration of emerging technologies, such as artificial intelligence, robotics, and advanced sensors, in NDT education. Furthermore, the research investigates the alignment of NDT education programs with industry demands and standards. Key trends identified in NDT education include a shift towards interdisciplinary programs that combine NDT with other engineering disciplines, an increasing emphasis on hands-on practical training using state-of-the-art equipment, and the incorporation of virtual simulations to enhance learning experiences. Additionally, the study highlights the importance of fostering collaborations between academia and industry to bridge the gap between theoretical knowledge and practical application. The abstract concludes by emphasizing the need for continuous updates to NDT curricula to keep pace with technological advancements and industry requirements. It underscores the importance of nurturing a skilled workforce in the Asian region to meet the growing demand for NDT professionals and ensure the safety and reliability of critical infrastructure. This research provides valuable insights into the evolving landscape of NDT education in Asia, enabling universities, higher learning institutions, and industry stakeholders to adapt and prepare future NDT professionals for the challenges of tomorrow.

Keywords: education, training, ndt, skills, competence



The World Organisation for NDT

NDT skills and education needs in Asia

ACADEMIA NDT INTERNATIONAL RESEARCH DAY 2024

Section 4: The Future-Now of NDT/E Education and Skills

Dr. Ir. Sajeesh K BABU
ICNDT Chairman

* The presentation is an individual contribution by the author not vetted by any organization represented by the author.



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NDT Skills & Education Needs in Asia

■ Driven by Stakeholders

- Clients, Regulatory bodies, Third Party Consultants, NDT Service Organization

Client
Specification

Standards

Regulations



International
Standard

ISO/ASTM TR
52905:2023

Edition 1
2023-06

Additive manufacturing of metals —
Non-destructive testing and
evaluation — Defect detection in
parts



26 July 2017

Authorised Examiners



REQUIREMENTS FOR NON DESTRUCTIVE TESTING/EXAMINATION OF STATUTORY EQUIPMENT
(LIFTING EQUIPMENT AND PRESSURE VESSELS) UNDER WSH ACT

This document sets the guideline for the conduct of non-destructive testing/examination (NDT) on hoist or lift, lifting gear, lifting appliance, lifting machine, steam boiler, steam receiver, air receiver, refrigerating plant pressure receiver, pressure vessels, or any other machinery required under the Workplace Safety and Health Act ("WSH Act") (hereafter referred to as "statutory equipment") to be tested and examined by an Authorised Examiner ("AE").

2 Non-destructive testing/examination of statutory equipment shall be carried out by a testing laboratory which is accredited by the Singapore Accreditation Council (SAC) under the Singapore Laboratory Accreditation Scheme (SAC-SINGLAS). The NDT reports shall be documented and endorsed in accordance with SAC-SINGLAS requirements. Examples of NDTs required to be conducted by laboratory accredited under the SAC-SINGLAS include thickness gauging, magnetic particle inspection and radiography of statutory equipment.



NDT Skills and Education needs in Asia

- Non-Destructive Testing (NDT) plays a pivotal role in ensuring the safety and integrity of critical infrastructure across various industries.
- As technological advancements continue to reshape the landscape of NDT, it becomes imperative to examine the trends in NDT skills & Education.
- I will address the situation in Asia and how various schemes and Higher learning institutes are preparing for way forward.
- Asia is a user of both European and American Innovations
- Asia is blended with both US & EU standards; this gives a big difference in how NDT is being operated in Europe or say in United States.
- The region shifting to recognize the **need of third-party certifications, more and more requirements of ISO 9712 specified on client specifications & contracts.**
- Countries at large with implementation of third-party certifications included Australia, China, India, Japan Singapore, Malaysia, Korea, Indonesia etc. in the field of infrastructure, Oil & gas, Marine & Offshore and power.



NDT Knowledge, Skill Vs Competence

- Knowledge, skill, Attitude are the attributes which provide the competency for practice or trade.
- Competency is the demonstration of knowledge and abilities to attain the desired outcome of a specific laboratory activity. A competent person means qualified to perform the specific job to attain the intended results.
- Functional competence (skills or know-how), those things that a person should be able to do when they work in a given area; Tested by an NDT Specific & Practical examination, however this is not sufficient.
- Hence such employer competence which is more than skill should be enlightened by the employer and assessed before putting the inspectors into action.
- The current Evolution of Level 1, Level 2, Level 3 will be assisted with technology in terms of testing & data acquisition and assisted by AI in terms of Interpretation, where there could be a lot of productivity improvement can be seen in the Testing

Competence

Knowledge

Skills

Attitude

Certification Schemes operating in Asia

- 1. ASNT (American Society for Non-Destructive Testing) – SNT-TC-1A Scheme – Employer based
- 2. ASNT (American Society for Non-Destructive Testing) – ASNT Level 3 – Accredited by ANAB and recently ASNT ISO 9712 (Unaccredited)
- 3. BINDT – (The British Institute of Non-Destructive Testing) PCN Scheme through various authorized qualifying bodies based on ISO 9711:2012, Accredited to ISO/IEC17024
- 4. TWI – (The Welding Institute, UK)-CSWIP Scheme delivered through various examination centres based on ISO 9712, Accredited to ISO 17024, mostly delivered in SE Asia
- 5. AINDT – (Australian Institute of Non Destructive Testing) direct by Certification body based on ISO 9712, Accredited to ISO 17024
- 6. ChsNDT – (Chinese Society for Non Destructive Testing) directly by Certification body through various chapters based on EN473 & ISO 9712, Approved through EFNDT MRA assessment.
- 7. JSNDI – (The Japanese Society for Non -Destructive Inspection) directly by Certification body based on ISO 9712(mod)
- 8. NDTSS – (Non-Destructive Testing Society (Singapore)) SGNDT Scheme through AQB based on ISO 9712 :2021- SAC Accredited.
- 9. ISNT – (Indian Society for Non-Destructive Testing), ISNT scheme through various chapters based on IS 13805 & ISO 9712:2012 – ICN Scheme
- 11. MSNT – Malaysian Society for NDT, DSD Malaysia Scheme based on ISO 9712, Accredited to ISO 17024
- 12. Other –National Programs such as Autri in Indonesia to ISO 9712 only for RT, AERB in India, Boiler & Power dept in China.

How do we attract Youth into our Industry

Student High School
Education/Technical
School

Assistant Gaining
Experience
at Employer
by obtaining
NDT
knowledge
& skills

Inspector Attending
External
Training
course and
Certification
Examination
– ISO 9712

Student Technical
School,
Diploma,
Degree
Syllabus -
NDT
Knowledge &
Skills

Assistant Gaining
Experience
including
Digitalization,
AI

Inspector Taking
Certification
Examination
– ISO 9712

SINGAPORE - General

- For most universities in Singapore, NDT is taught as part of materials or mechanical engineering courses

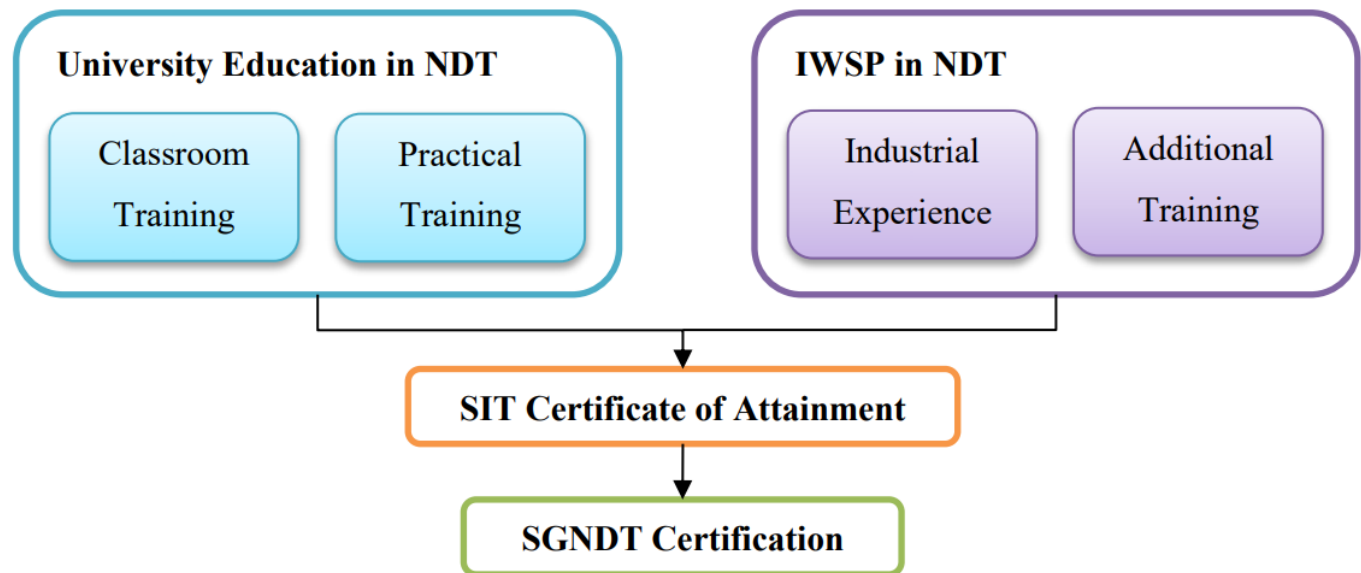


The World Organisation for NDT

SINGAPORE - SIT



■ Integrated Workplace Study Programme – An Engineer to Professional



SINGAPORE -SIT

■ Integrated Workplace Study Programme – An Engineer to Professional



Singapore – Republic Polytechnic



MEDIA RELEASE

Republic Polytechnic and SETSCO partner to boost Aerospace MRO manpower qualifications

Collaborative Training and Certification Agreement to provide aerospace students with industry experience and certification in non-destructive testing

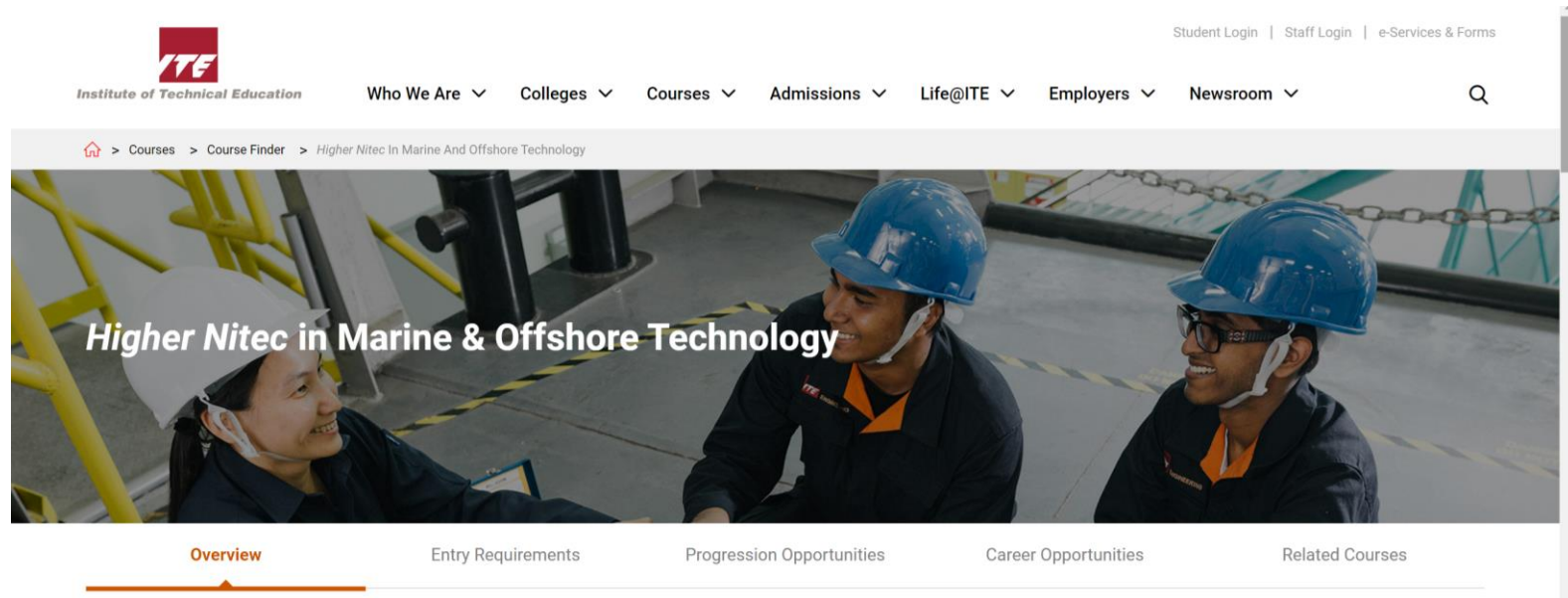
SINGAPORE, 19 November 2014 – Singapore has become an important and competitive hub for aerospace maintenance, repair and overhaul (MRO) and for good reason too. With over 100 aerospace companies based in Singapore, and a key geographical location, Singapore now contributes to over a quarter of Asia-Pacific's MRO services¹.

Non-destructive testing (NDT) is one of the key activities undertaken by MROs to ensure structural integrity of aircraft components which includes airframe, engine, parts and other critical components.

With the growing demand for qualified and skilled manpower in Singapore, in particular specialists in NDT, Republic Polytechnic (RP) has initiated a five-year Collaborative Training and Certification Agreement with Setsco Services Pte Ltd (SETSCO), a leading player in the NDT field to provide established international NDT personnel certification to its students.



Singapore – Institute of Technical Education



The screenshot shows the ITE website header with the logo and navigation links: Who We Are, Colleges, Courses, Admissions, Life@ITE, Employers, and Newsroom. A search icon is also present. Below the header, a breadcrumb trail reads: Home > Courses > Course Finder > Higher Nitec in Marine And Offshore Technology. The main banner features a photo of three students in blue hard hats and dark uniforms, smiling. The text 'Higher Nitec in Marine & Offshore Technology' is overlaid on the image. Below the banner, a horizontal menu highlights 'Overview' with an orange underline, followed by 'Entry Requirements', 'Progression Opportunities', 'Career Opportunities', and 'Related Courses'.

What you'll learn

- Interpret general arrangement drawings, pipe and instrument drawings, welding procedure specifications, and test procedures
- Perform preliminary design of pipe routing plan
- Perform non-destructive tests on weld metals
- Perform planning of work activities such as lifting, erection of supports for assembly works, manpower deployment and work schedule
- Perform inspection on brazed joints, pre-welding and post-welding, and alignment of pumps
- Assist in system testing and commissioning of marine auxiliary system and drilling system
- Perform supervision on fabrication and welding
- Perform quality control checks of welding, painting and blasting, insulation, machinery and electrical installations

South Korea

■ □ NDT Education and Research

- ○ National Academic Classification System : - Classified in Mechanical Engineering
 - R&D funding is supported by NRF(National Research Foundation) of Korea(<https://www.nrf.re.kr/eng/index>)
 - Supported under the NDT Promotion and Management Act(Since 2005)

□ NDT Education at University level

- Subject Name : NDE Engineering, Ultrasonic Diagnosis Engineering etc.
 - Basically, a secondary discipline, - Cannot be studied in isolation
 - There is no separate Department of NDE Engineering in Korea
 - Mainly, it is opened as Advanced NDE Engineering, Ultrasonic Diagnosis Engineering etc. in the graduate school curriculum

South Korea- Seoul National University of science & Technology



서울과학기술대학교
SEOUL NATIONAL UNIVERSITY OF SCIENCE & TECHNOLOGY

서울과학기술대학교

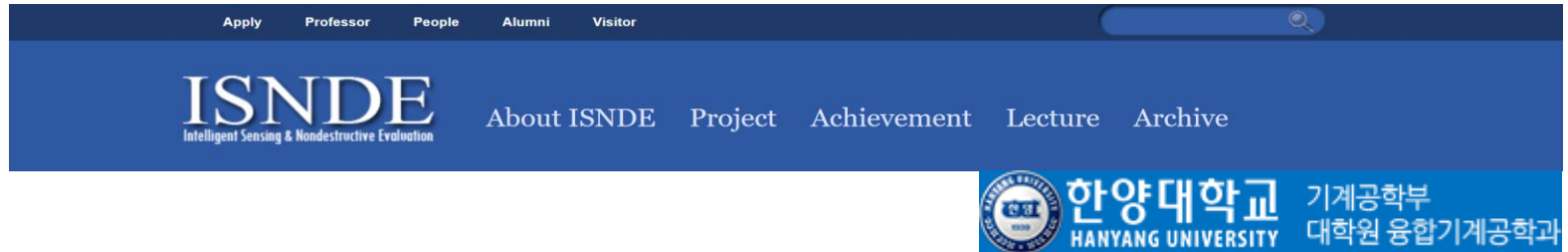
NDT 실증연구센터

SeoulTech NDT Research Center

- Representative NDT Education Institutions(Professor) at University level
- ○ Seoul National University of Science and Technology(SeoulTech)
- - Department of Mechanical and Automotive Engineering(Education)
- (<https://mae.seoultech.ac.kr/en/curriculum/course/>) - NDT Research Center(Research) (<http://snde.net/frontpage.asp?catalogid=sndt&language=ko>)
- - Subject Name : NDE Engineering(undergraduate course, the senior class),
- 3 credits and 3 hours,
- Ultrasonic Diagnosis Engineering(graduate course): 3 credits and 3 hours, -
Professor : PARK, Ik Keun



South Korea- Hanyang University



- - Graduate School of Mechanical Engineering, Department of Mechanical Engineering(Education) (<https://me.hanyang.ac.kr/>) - Intelligent Sensing and NDE Lab(Research) (<http://isnde.hanyang.ac.kr/>) - Subject Name : Acoustics(graduate course), 3 credits and 3 hours,
- Ultrasonic Engineering(graduate course): 3 credits and 3 hours,
- - Professor : JHANG, Kyung Young

South Korea- Sungkyunkwan, PNU, KAIST

■ Sungkyunkwan University

- (https://mech.skku.edu/me_eng/index.do) Graduate School of Mechanical Engineering(Education)
- Subject Name : NDE Engineering(3 credits and 3 hours)
- Professor : SONG, Sung Jin

■ Busan University

- Graduate School of Mechanical Engineering, Department of Mechanical Engineering(Education)
- Professor : CHO, Younho

■ KAIST

- Graduate School of Aerospace Engineering(Education)
- (<https://ae.kaist.ac.kr/>) Professor : LEE, Jung Ryul Graduate School of Civil Engineering(Education)
- (<https://cee.kaist.ac.kr/>) Professor : SOHN, Hoo



South Korea – Asea Aviation College



ASEA Aviation College

KOR

ENG

[Greetings](#)

[ABOUT](#)

[Campus Tour](#)

[Majors](#)

[Majors](#) > [Faculty of Non-destructive Testing](#) > [Department of Non-destructive Aircraft Testing](#)

Majors

Faculty of Aircraft Maintenance

- Department of Aircraft Maintenance Licenses
- Department of Aero-Mechanical Engineering
- Department of Aviation Non-commissioned Officers
- Department of Helicopter Maintenance
- Department of Unmanned Aerial Vehicle (UAV)

[Faculty of Non-destructive Testing](#)

- [Department of Non-destructive Aircraft Testing](#)
- Department of Ultrasonic Testing
- Department of Non-destructive Safety Management
- Department of Non-destructive Technical Non-commissioned Officers

Department of Non-destructive Aircraft Testing



Educational Goals

Non-destructive testing involves the inspection of nuclear power facilities, railroads, aircraft, or diverse structures through X-rays or ultrasonic waves instead of disassembly or destruction of testing objects for the purpose of carrying out the reliability/safety assessment of the properties.

The Department of Non-destructive Aircraft Testing offers courses covering both aircraft maintenance techniques and non-destructive testing skills so that its students can carry out the entire range of related tasks from assessment to maintenance. Students can acquire the relevant licenses. The department is committed to cultivating professional technicians optimized for the aviation industry.

[Educational Goals](#)

[History](#)

[Special Merits of ASEA](#)

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India – MTech NDT

- The National Institute of Technology (formerly Regional Engineering College) Tiruchirappalli was established as a joint venture of the Government of India and the Government of Tamil Nadu in 1964 to produce world-class engineers who will cater to the growing technological needs of the nation. The institute was granted Deemed University status with the approval of the UGC / AICTE and Government of India in 2003 and renamed as National Institute of Technology, Tiruchirappalli (NIT-T).
- 26 PG courses are offered in this Institute
- Admission to M.Tech are based on the scores in the Graduate Aptitude Test in Engineering (GATE) and the admissions are through the Centralized Counseling for M.Tech. / M.Arch./ M.Plan.. Admissions (CCMT).
- Eligibility :
 - Should have completed Undergraduate in the engineering stream mainly in Mechanical / Production / Metallurgy .
 - Should have completed Post Graduate in the Science stream mainly in Physics.
- M.Tech is a two years programme.



India – MTech Course Curriculum

- Covers conventional NDT methods namely Visual Testing, Penetrant Testing, Magnetic Particle Testing, Ultrasonic Testing & Radiography Testing both theory classes as well as practical.
- Covers advance NDT methods namely Phased Array Ultrasound Testing & Time Of Flight Diffraction both theory classes as well as practical.
- During the final year, candidates will be doing research works in the field of NDT in various industries.



India – IIT Chennai, Industrial Consultancy & Sponsored Research (IC&SR) , IIT Madras, PhD Programs

- Non-Destructive Testing Methods & Equipment (NDT/NDE)
- IDF No 2117 A System and a Method for Detecting and Characterizing a Defect in an Object using Guided Wave Inspection
- IDF No 1448 Quadratic Electro-optic Based Deflection-free Wide Path-length Modulation and Lateral Scanning Device for Time Domain Optical Coherence Tomography
- IDF No 1116 A Device and Methods for Determining the Elemental Identity and Analysis on Moving Target from A Variable Stand-off Distance
- IDF No 861 A Method for Non-destructive Structural Health Monitoring
- IDF No 1685 A Method of Manufacturing a Slit Mask for In-situ Laser Ultrasonic Inspection of Additively Manufactured Components
- IDF No 1217 Underwater Remote Operated Vehicle (ROV) for Performing Non-destructive Evaluation (NDE) of Submerged Pipeline Structures
- IDF No 2124 Method and System for Generating Time-efficient Synthetic Non-Destructive Testing Data
- IDF No 2455 Staircase Shaped Magnetostrictive Patch (ScaMP) Transducer
- IDF No 1824 Spherical Robot for Internal Inspection of Pipelines

China - General

- The higher education of NDT in China began in Nanchang Hangkong University in 1982. Thirty-nine people were enrolled in that year, and thirty-six people graduated from this school to become the first group of graduates of NDT in China four years later. In 1984, as a specialty, NDT entered the undergraduate specialty catalog of higher education specified by the Chinese education ministry. Several universities such as Liaoning Shihua University, Dalian University of Technology set up the NDT specialty as well.
- The postgraduate education for NDT began in Beijing research institute of aeronautical material in 1978. Some top universities like Tsinghua University made a very important role in it.

China – 13 Universities, 800 Graduates by 1992

S/N	School name	Specialty	Founding time
1	Nanchang Hangkong University	NDT	1982
2	East China University of Science and Technology	Safety engineering	2010
3	Liaoning Shihua University	Safety engineering	1999
4	Beijing Institute of Technology, Zhuhai	Applied physics	2011
5	China Jiliang University	Safety engineering	
6	PLA Air Force No.1 Aviation University	aircraft damage test	
7	Xi'an Polytechnic University	Applied physics	2002
8	Lanzhou Polytechnical College	Welding technology	2015
9	Beijing Jiaotong University	Applied physics	1982
10	Wuhan University of Technology	Testing technology & instrument	1988
11	Beijing University of Science and Technology	Applied physics	1988
12	Dalian University of Technology	Metallic material	1987
13	Guangxi University	Applied physics	1986

China – NDT become a subject under other specialization

- The undergraduate specialty catalog was modified in 1992, instead of a specialty, NDT has become a lower level, that is specialization, of some other specialties like testing technology & instrument, safety engineering and so on. This obviously has significant influence to all the schools. For example, the specialty has changed to testing & controlling technology in Nanchang Hangkong University.
- Nanchang Hangkong University has been taking the lead of NDT higher education and owned very good reputation in China. The university created a very effective teaching plan and talent training program which served as the fundamental for the training of NDT specialty in the country. It set up a key lab of NDT supported by education ministry of China, and postdoctoral research station.

China – Post Graduate Level

Table 2 Information about academic education—postgraduate

S/N	School name	Specialty	Founding time
1	Tsinghua University	NDT	1985
2	Beihang University	Mechanical & electrical engineering	2000
3	Dalian University of Technology	Metallic material	1987
4	East China University of Science and Technology	Safety engineering	
5	Huazhong University of Science and Technology	Mechanical & electrical engineering	1984
6	Beijing Jiaotong University	Applied physics	
7	Tongji University	Acoustics	
8	Nanjing University	Acoustics	
9	Nanjing University of Aeronautics and Astronautics	Electrical technology	
10	Beijing acoustic institute of Chinese Academy of Sciences	Acoustics	
11	Nanchang Hangkong University	testing and metrology technology & instrument.	1996
12	Wuhan University of Technology	Testing technology & instrument	
13	Beijing University of Science and Technology	Applied physics	
14	Beijing research institute of aeronautical material	NDT	1978
15	Beijing research institute of aeronautical process	NDT	1978
16	Xi'an Polytechnic University	Applied physics	2015
17	Harbin institute of welding technology	Welding	1986
18	Beijing University of Technology	Applied physics	1988
19	Shenyang metallic research institute of Chinese academy of science	Materials Processing Engineering	1987
20	South China University of Technology	Intellectualized testing & control	
21	Daqing Petroleum University	Chemical Process Equipment	1985

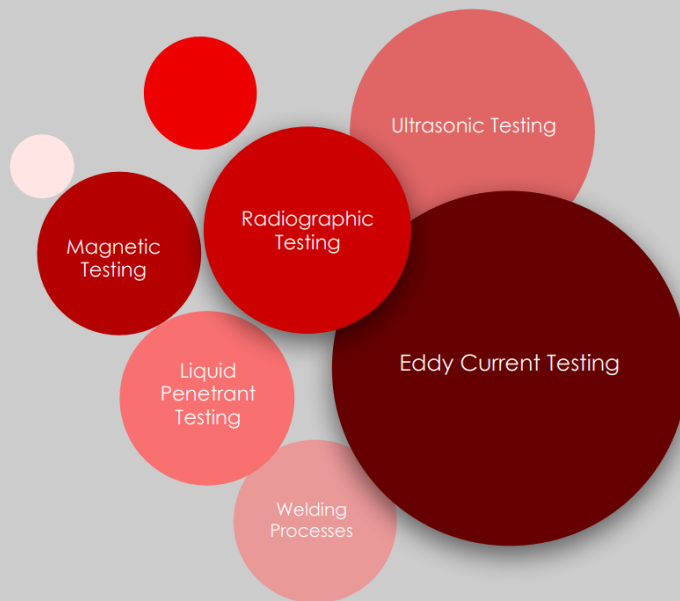
China – Polytechnic Diploma Level

Table 3 Information about vocational education

S/N	School name	classification	Length of schooling (year)	Founding time
1	Shenzhen Polytechnic	Higher vocation	3	2004
2	Liaoning Mechatronics College	Higher vocation	3	1999
3	Hunan Labor and Human Resources Vocational College	Secondary vocation Higher vocation	5 3	1991 1993
4	Nanchang Hangkong University	Higher vocation	3	2003
5	Naval Aeronautical and Astronautical University, Qindao	Junior college	3	2002
6	Shanxi Polytechnic Institute	Higher vocation	3	2002
7	Changsha Aeronautical Vocational and Technical College	Higher vocation	3	1985
8	Changzhou Vocational Institute of Engineering	Higher vocation	3	2006
9	Xi'an Aeronautical Polytechnic Institute	Higher vocation	3	2007
10	Hebei Mechatronics College	Higher vocation	3	1997
11	Sichuan Engineering Technical College	Higher vocation	3	2002
12	Inner Mongolia Technical College of Mechanics and Electrics	Higher vocation	3	2005
13	Hebei Technical College of Petroleum Profession	Higher vocation	3	2004
14	Henan Wuyang Metallurgy Vestibule School	Secondary vocation	3	2008
15	Bohai Ship-building Vocational College	Higher vocation	3	2003
16	PLA Air Force No.1 Aviation University	Junior college	3	1992
17	Shandong College of Electric Power	Junior college	3	2005
18	Liaoning Guidao Jiaotong Polytechnic Institute	Higher vocation	3	2013
19	Hefei Institute of General Professional Technology	Higher vocation	3	2000
20	Chengde Petroleum College	Junior college	3	2006
21	Liaoning Shihua University	Junior college	3	1990
22	Tianjin Maritime College	Higher vocation	3	2006
23	Shandong Polytechnic	Higher vocation	3	2010
24	Lanzhou Petrochemical College of Vocational Technology	Higher vocation	3	2011
25	Changzhou Railway Higher Vocational and technical School	Higher vocation	3	
26	Liaoning Jinxi Industry School	Secondary vocation	3	

Malaysia - TATI

CORE COURSES



FACULTY OF ELECTRICAL
AND AUTOMATION
ENGINEERING TECHNOLOGY

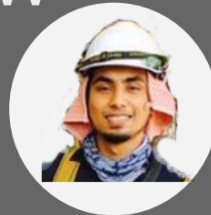


**DIPLOMA in
NON-DESTRUCTIVE
TESTING**

R/521/4/0081, 09/2019, A10074

Malaysia - Tati

- Diploma in Engineering Technology (Non-Destructive Testing)
- Offered by: University College TATI (UC TATI)
- 3 Years program, Full Time
- Courses offered:
 - A full range of ultrasonic, magnetic particle and penetrant testing courses are offered on an almost continuous basis throughout the year. Also, a wide range of additional courses can be offered in association with IMechE Argyll Ruane, including radiographic interpretation (PCN) and weld inspection (PCN). Courses and examinations are available on-site as well as in the training and examination centre. Ruane-TATI is an authorised examination centre under IMechE Argyll Ruane offering a wide range of PCN examinations. In addition, Ruane-TATI also offers radiographic testing courses and examinations for the Malaysian scheme (SKM/JPK).



Zikril Hafiz Maizam

(Diploma in Non-Destructive Testing)

NDT Inspector

Energy Workforce Sdn. Bhd.

I was offered jobs by several NDT companies upon my graduation as programs offered in TATIUC is on par with programs by international universities



Chinese Taiwan

- Chaoyang University of Technology
- Academic Year 1st Semester
- Course Name : Non-destructive Testing and Practices
- Department of Aeronautical Engineering
- Credits 3, 3hours /week, 16 weeks
- This course introduces the fundamental concept of wave propagation and selected topics on nondestructive testing (NDT) for
- engineering applications. NDT techniques such as ultrasonic testing, magnetic testing, thermography testing, and visual testing
- will be demonstrated.
- 1. Concept of wave propagation
- 2. NDT applications for mechanical and aerospace engineering
- 3. Ultrasonic testing: basics and demonstrations
- 4. Magnetic testing: basics and demonstrations
- 5. Visual testing
- 6. Thermography testing



A New Model of NDT Education from Universities & Technical College



Major in Mechanical

Specialisation in NDT
(Ultrasonics, Magnetic,
Acoustics)



Major in Civil

Specialisation in NDT
(Low frequency Ultrasonics,
Microwave, Infrared
Thermography, Structural
Imaging techniques (Radar,
Concrete diagnostics)



Major in Electrical &
Communications

Specialisation in NDT
ET, Infrared, Robotics, AI
Applications



TR ISO/TS 25107:2022
ISO/TS 25107:2019, IDT
(CEC 19-100)

TECHNICAL REFERENCE
Non-destructive testing – NDT training
syllabuses

Curriculum shall be developed in accordance with Syllabus - ISO/TR 25107 Compliance

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- **ChineseTaiwan-** Prof CHIH HUNG CHIANG

Questions?

Thank you for listening!
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