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# Non-Destructive Testing — Complete Syllabus

BTEUP Diploma in Mechanical Engineering (Production) • 6th Semester • Session 2026–27

Subject 6.4.3 (Theory) • Elective Specialization • Total 100 Marks • 3 Credits

**About this document:** Non-Destructive Testing is subject 6.4.3 of the 6th semester of the Diploma in Mechanical Engineering (Production). It is one of the four Elective Specialization options — a student picks any ONE of the four: Green Energy & Engineering (6.4.1), Maintenance of Machine Tools (6.4.2), Non-Destructive Testing (6.4.3) and Product Design & Development (6.4.4). This document gives the complete unit-wise syllabus, the examination scheme and the reference books from the official curriculum.

## Examination Scheme

| Code | Paper | Type | L – P | Credits | Internal | External | Total |
|---|---|---|---|---|---|---|---|
| 6.4.3 | Non-Destructive Testing | Theory | 3 – 0 | 3 | Theory 40 | Theory 60 (3 hrs) | 100 |
| **Non-Destructive Testing Total** | | | | **3** | **40** | **60** | **100** |

## What This Subject Aims To Do

To teach students how materials, components and assemblies are inspected and evaluated without destroying them — finding cracks, voids and weld defects — so that catastrophic failures in aircraft, pipelines, reactors and ships can be prevented.

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## Unit-Wise Complete Topic List

| Unit | Topic | Periods | Marks |
|---|---|---|---|
| 1 | Introduction to NDT | 6 | 12 |
| 2 | Visual Inspection and Liquid Penetrant Test | 8 | 12 |
| 3 | Magnetic Particle Test and Eddy Current Test | 10 | 12 |
| 4 | Ultrasonic Test and Radiography Test | 10 | 12 |
| 5 | Other NDT Techniques | 8 | 12 |

Total: 42 periods, 60 marks (external theory). Each of the five units carries 12 marks in the external theory paper, as per the suggested distribution of marks in the official syllabus.

### Unit 1 — Introduction to NDT (6 Periods, 12 Marks)

**Topics:** Non-Destructive Testing (NDT) and comparison with Destructive Testing, defects/flaws due to: primary processing, secondary processing, in-service conditions, types of defects detected by NDT, common NDT techniques, advantages, limitations, and applications of NDT.

**In simple words:** What non-destructive testing is, how it differs from destructive testing, and the defects it is meant to find.

### Unit 2 — Visual Inspection and Liquid Penetrant Test (8 Periods, 12 Marks)

**Topics:** Principle of visual inspection, defects detectable by unaided visual inspection, optical aids used in visual inspection, advantages and limitations of visual inspection, advantages and limitations of LPT, physical principles of LPT, procedure for conducting LPT, penetrant methods, materials used in LPT.

**In simple words:** The two simplest methods — looking carefully (visual inspection) and liquid penetrant testing — how they work and where they stop.

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### Unit 3 — Magnetic Particle Test and Eddy Current Test (10 Periods, 12 Marks)

**Topics:** Advantages and limitations of MPT, procedure for MPT, magnetizing techniques, magnetic particles and suspending liquids, detectable discontinuities, non-relevant indications, applications, advantages and limitations of ECT, operating variables, eddy current instrumentation, reference standards, applications.

**In simple words:** Magnetic particle testing and eddy current testing — the principles, the instruments, and what each one can and cannot find.

### Unit 4 — Ultrasonic Test and Radiography Test (10 Periods, 12 Marks)

**Topics:** Advantages and limitations of UT, general characteristics of ultrasonic waves, wave propagation and types of ultrasonic waves, major variables in UT, angle beam techniques, immersion testing, applications, uses and applicability of RT, advantages and limitations of RT, interaction between penetrating radiation and matter (attenuation), image conversion media, film radiography, real-time radiography.

**In simple words:** Ultrasonic testing and radiographic testing — sound waves and penetrating radiation used to see inside a part.

### Unit 5 — Other NDT Techniques (8 Periods, 12 Marks)

**Topics:** Acoustic emission inspection, microwave inspection, thermal inspection, electromagnetic techniques for residual stress measurements, optical holography.

**In simple words:** The advanced methods — acoustic emission, microwave, thermal inspection, residual stress measurement and optical holography.

## Learning Outcomes

- Study the fundamentals of Non-Destructive Testing, types of defects, and compare NDT with destructive testing methods.
- Explain the principles, procedures, advantages, and limitations of Visual Inspection and Liquid Penetrant Testing (LPT).
- Analyze the principles, instrumentation, applications, and limitations of Magnetic Particle Testing (MPT) and Eddy Current Testing (ECT).
- Explain the working principles, techniques, and applications of Ultrasonic Testing (UT) and Radiographic Testing (RT).
- Study advanced and special NDT techniques such as acoustic emission, microwave inspection, thermal inspection, residual stress measurement, and optical holography.

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## Reference Books (as listed in the syllabus)


- Non Destructive Evaluation and Quality Control, Metals Handbook, Vol. 17, 9th Ed., ASM, 1989.
- K. C. Srivastava, Handbook of Magnetic Particle Testing, Oscar Publications, 1998.
- B. Hull, Non Destructive Testing, Springer, 2012.
- Dr. V. Jayakumar, Dr. K. Elangovan, Non-Destructive Testing of Materials, Lakshmi Publications, Chennai, 2017.
- Baldev Raj, T. Jayakumar, M. Thavasimuthu, Practical Non-Destructive Testing, 3rd Ed., Narosa.


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Source: IRDT Kanpur NEP-2020 curriculum for the Diploma in Mechanical Engineering (Production), updated and approved by the Board of Technical Education, U.P., Lucknow, in the C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-language summaries, not syllabus text. Please confirm with your own polytechnic for any local changes.

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