

Your Metallurgy & Materials Journey Starts Here

A first look at the courses, credits and hands-on lab skills waiting for you in Semester I & II

5

COURSES

15

TOTAL CREDITS

2

SEMESTERS



COEP TECHNOLOGICAL UNIVERSITY, PUNE
Metallurgy and Materials Engineering Department
A.Y. 2026–27

Your First Year, At a Glance

Five courses across two semesters take you from crystal structures and nanoscience to corrosion control and industrial furnaces.

SEMESTER I

9 CREDITS TOTAL



**Structure and Properties of
Materials**

3 Credit

Engineering Science Course • ES-I THEORY + LAB



Nanomaterials

3 Credit

Engineering Science Course • ES-II THEORY



**Fundamentals of Corrosion
Engineering**

3 Credit

Engineering Science Course • ES-III THEORY +
PRACTICAL

SEMESTER II

6 CREDITS TOTAL



Nanomaterials

3 Credit

Engineering Science Course • ES-IV THEORY



Fuels, Furnaces and Refractories

3 Credit

Programme Core Course • PCC THEORY + LAB

INSIDE OUR LABORATORIES

Where Theory Meets Real Equipment

Testing, corrosion and characterisation facilities in the Department that connect directly to your first-year courses.



X-Ray Diffractometer

Bruker D8 Advance · phase identification, residual stress



FE-SEM with EDS

Carl Zeiss Sigma · surface topography, failure analysis



Universal Testing Machines

10T, 20T & 60T · high-temperature testing to 1000 °C



Pendulum Impact Tester

FIE IT-30 · Izod & Charpy toughness tests



Potentiostat / Galvanostat

Gamry Interface 1000 · electrochemical corrosion



Cyclic Corrosion Chamber

Equilam · salt-spray testing per ASTM B117



FTIR Spectrometer

JASCO FTIR-4100 · compound identification



High-Temperature Muffle Furnace

Therelek · up to 1700 °C, MoSi₂ heating elements

Semester One

Your starting point — how crystal structure shapes properties, why materials behave differently at the nanoscale, and how to stop metals from corroding.

3

COURSES

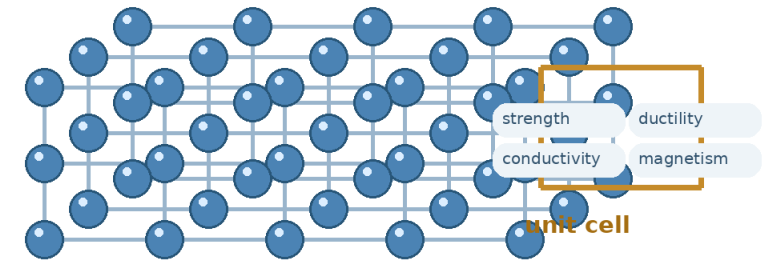
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CREDITS



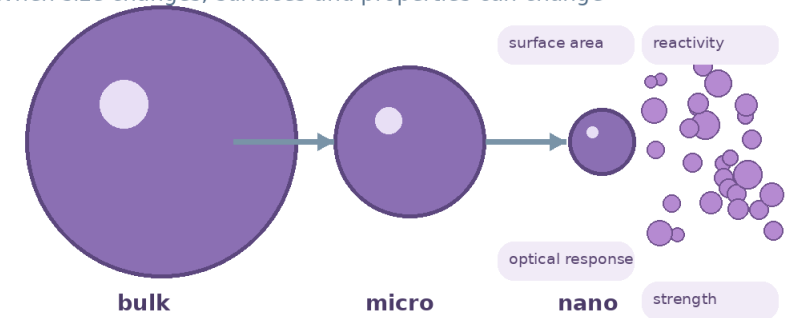
CRYSTAL STRUCTURE

Atomic arrangement → bonding → properties



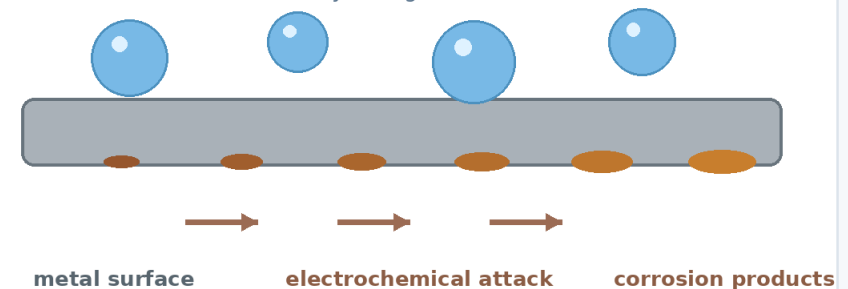
NANOSCALE EFFECTS

When size changes, surfaces and properties can change



CORROSION & DURABILITY

Environment + electrochemistry → degradation





Structure and Properties of Materials

Engineering Science Course (ES-I) • Compulsory

THEORY + LAB

3

CREDITS

WEEKLY STRUCTURE

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EVALUATION SCHEME (100 MARKS)

MSE 30

CIE 20

ESE 50

+ *Laboratory: continuous internal evaluation — tensile, hardness, impact, torsion, bend & NDT experiments, journal, viva-voce*



WHAT YOU'LL LEARN

1

UNIT 1

Crystal Structures

Space lattices, FCC / BCC / HCP metals, Miller indices, linear & planar density, polymorphism and anisotropy.

2

UNIT 2

Crystal Defects

Point, line and planar imperfections; edge, screw and mixed dislocations; slip systems and Schmid's law.

3

UNIT 3

Mechanical Properties

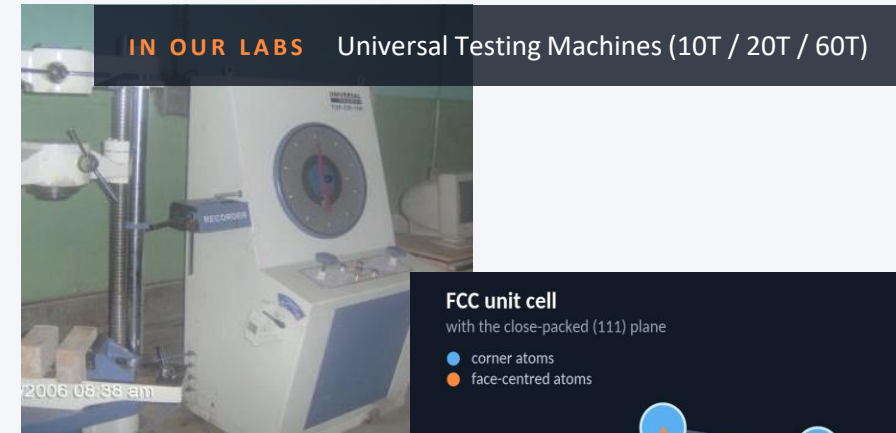
Engineering vs true stress–strain, hardness, toughness, fatigue, creep, fracture and non-destructive testing.

4

UNIT 4

Electrical, Optical & Thermal Properties

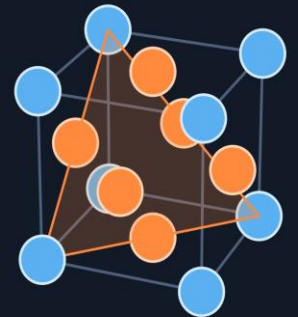
Resistivity, energy gap, ferromagnetism, dielectrics, refractive index, heat capacity, thermal shock.



FCC unit cell

with the close-packed (111) plane

- corner atoms
- face-centred atoms



ILLUSTRATIVE Crystal models you'll build and visualise



Structure and Properties of Materials

In practice — hands-on skills, career value and where this course takes you

THEORY + LAB



HANDS-ON IN THE LAB

Tensile & compression (UTM)

Brinell / Vickers / Rockwell hardness

Microhardness

Shore scleroscope

Impact test

Torsion test

Bend test

Dye penetrant

Magnetic particle

Eddy current

Radiography

Ultrasonic testing



WHERE IT APPLIES

Metallurgy & Materials — Compulsory Semester I foundation — every Metallurgy student completes it.

Mechanical • Manufacturing • Civil — Useful for material selection and failure analysis.

Later semesters — Groundwork for physical metallurgy, mechanical metallurgy and materials characterisation.

Offered as a Metallurgy branch-mandatory subject, not an open elective.



IN OUR LABS Pendulum Impact Tester (FIE IT-30)



Structure and Properties of Materials

Engineering Science Course (ES-I) · Compulsory

THEORY + LAB

Why it matters to you?



1. Why it matters

- Materials are the backbone of modern engineering and technology.
- Helps you understand why materials behave the way they do.
- Essential for selecting, designing and using materials intelligently.



2. What you build

- Strong fundamentals in crystal structure, defects and mechanical behaviour.
- Ability to analyse stress-strain, hardness, toughness and failure.
- Practical testing and characterisation skills.



3. Placement relevance

- Core knowledge used in manufacturing, quality control, failure analysis and R&D.
- Relevant for roles in materials, mechanical, manufacturing, automotive, aerospace and infrastructure sectors.



4. Opportunity pathways

- Core engineering roles (materials, metallurgical, mechanical, manufacturing).
- Higher studies and research (M.Tech., Ph.D.) in materials and related areas.
- Specialized fields: advanced materials, materials characterisation, failure analysis, materials design.

*Understand Materials.
Build a Stronger Future.*



"Better Materials. Brighter Possibilities."

Note: Career areas shown are indicative. Placements depend on overall skills, CGPA, projects and opportunities, and are not attributed to a single course.

Skills for the Real World



Material selection and design thinking



Use of industry-relevant testing and NDT methods



Data analysis and technical reporting



Problem solving for real engineering challenges

Where can you work?



Core industries (steel, aluminium, cement, etc.)



Automotive and aerospace



Manufacturing and heavy engineering



Infrastructure and construction



Electronics and semiconductors



R&D, testing and consultancy



Build the Foundation for Your Future

A strong understanding of materials opens doors to diverse industries, innovative technologies and exciting career opportunities.



Nanomaterials

Engineering Science Course (ES-II)

THEORY

3

CREDITS

WEEKLY STRUCTURE

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EVALUATION SCHEME (100 MARKS)

MSE 30

CIE 20

ESE 50

Theory-only course — no laboratory component



WHAT YOU'LL LEARN

1

UNIT 1

Introduction to Nanomaterials

History and scope, bio- and magnetic nanomaterials, surface energy, defects and nanoparticle stability.

2

UNIT 2

Fundamentals of Nanoscience

0D–3D nanostructures, quantum confinement, size-dependent properties, tunnelling, density of states.

3

UNIT 3

Synthesis Approaches

Top-down milling, lithography and etching; bottom-up sol–gel, CVD, self-assembly and green synthesis.

4

UNIT 4

Characterisation Techniques

Electron microscopy (SEM, TEM, AFM), spectroscopy (XRD, UV-Vis, FTIR, Raman) and DSC / TGA.

5

UNIT 5

Applications

Nanostructured steels and coatings, batteries and solar cells, water purification, drug delivery, MEMS / NEMS.

6

UNIT 6

Ethics, Safety & Society

Nanotoxicology and safety, sustainability and circular economy, regulation, AI in nanotechnology.



Nanomaterials

In practice — key techniques, career value and where this course takes you

3

THEORY

CREDITS



TECHNIQUES YOU'LL STUDY

SEM

TEM

AFM

XRD

UV-Vis

FTIR

Raman

DSC

TGA

SEM, XRD, FTIR, UV-Vis, DSC and TGA instruments are all housed in our department.



WHERE IT APPLIES

Metallurgy & Materials — Nanostructured metals, coatings and composites.

Mechanical & Manufacturing — Advanced materials and surface engineering.

Electrical & E&TC — Functional materials, sensors, nanoelectronics.

Civil — Advanced construction materials and coatings.

CSE · Robotics & AI — Materials data, simulation and AI-enabled research.



IN OUR LABS FE-SEM (Carl Zeiss Sigma)

THE WORLD AT THE NANO SCALE

Nanomaterials

Small Dimensions. Big Opportunities.

Unique structures, properties and applications that are transforming materials and technology.



0D - 3D
Nanostructures



Quantum Effects
and Size Dependence



Synthesis and
Characterisation



Real-World
Applications

1 ANO TODAY
A BETTER TOMORROW

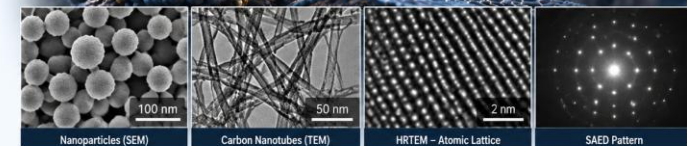
Atoms to Applications

Atoms
~ 0.1 nm

Nanoparticles
1 - 100 nm

Nanostructures
100 nm - 1 µm

Bulk Material
> 1 µm



Nanomaterials

Engineering Science Course (ES-II) • Theory

Small Dimensions. Enormous Possibilities.



Why it matters

- Nanomaterials show unique properties that are very different from bulk materials.
- Enable high performance, lightweight, energy efficient and sustainable technologies.
- Key to solving global challenges in energy, health, environment and electronics.



What you build / learn

- Understand synthesis methods (top-down and bottom-up).
- Learn to control size, shape, structure and surface properties.
- Analyse nanomaterials using techniques like XRD, SEM, TEM, UV-Vis, FTIR (covered in later semesters/labs).
- Develop skills to relate nano-scale structure to enhanced properties.



Placement relevance

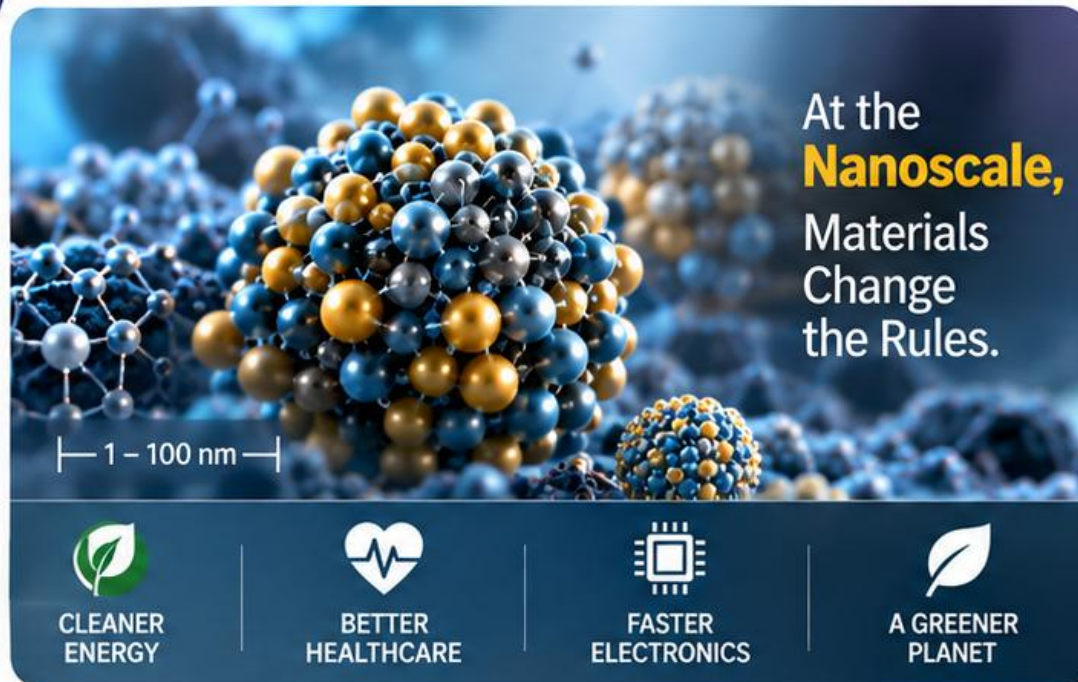
- Growing demand in R&D, advanced materials, electronics, energy and biomedical sectors.
- Relevant for roles in materials development, characterisation, quality control and process engineering.
- Valuable for higher studies (M.Tech., Ph.D.) in India and abroad.



Opportunity pathways

- Advanced materials (coatings, composites, nanomaterials)
- Semiconductor and electronic materials
- Energy (batteries, fuel cells, solar cells)
- Biomedical materials and drug delivery
- Research and academia
- Start-ups and innovation-driven industries

*Explore the Nano World
Create a Better Tomorrow*



CLEANER
ENERGY



BETTER
HEALTHCARE



FASTER
ELECTRONICS



A GREENER
PLANET

Real-World Examples



Nanostructured
materials for
high-efficiency
solar cells



Nanoparticles
for targeted
drug delivery



Nanomaterials
in next-generation
electronics



Nanomaterials
for water purification
and environmental
remediation

Skills for the Real World



Materials synthesis and processing



Characterisation and data analysis



Innovative and design thinking



Interdisciplinary problem solving

Where can you work?



R&D labs and advanced materials
companies



Semiconductor and electronics industry



Energy and environment sector



Biomedical and healthcare industry



Higher studies and research
(in India and abroad)

A Sustainable Future Needs Nanomaterials



From clean energy and smart electronics to better healthcare and a cleaner environment — nanomaterials are at the heart of future technologies. By learning nanomaterials, you position yourself to be part of this exciting and rapidly growing field.

“From Atoms to Applications.”



Fundamentals of Corrosion Engineering

Engineering Science Course (ES-III)

THEORY + PRACTICAL

3

CREDITS

WEEKLY STRUCTURE

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EVALUATION SCHEME (100 MARKS)

MSE 30

CIE 20

ESE 50

+ Practical: continuous internal evaluation — ten prescribed corrosion experiments, journal and viva-voce



WHAT YOU'LL LEARN

1

UNIT 1

Introduction to Corrosion Science

What corrosion is, everyday and industrial examples, economic and safety impact, wet / dry classification.

2

UNIT 2

Scientific Principles of Corrosion

Anodic and cathodic reactions, basic thermodynamic and kinetic concepts, factors that drive corrosion.

3

UNIT 3

Forms of Corrosion & Prevention

Uniform, galvanic, pitting and crevice corrosion; coatings, inhibitors, cathodic and anodic protection.

4

UNIT 4

Measurement, Testing & Standards

Weight-loss and visual rate measurement, ASTM / NACE / IS standards, inspection and safe practice.



IN OUR LABS Gamry Interface 1000 potentiostat



Fundamentals of Corrosion Engineering

In practice — hands-on skills, career value and where this course takes you

THEORY + PRACTICAL



HANDS-ON IN THE LAB

Electrode potential

Polarisation measurement

Galvanic corrosion

Crevice corrosion

Pitting corrosion

Stress-corrosion cracking (U-bend)

Liquid-metal embrittlement

Cathodic protection demo

Inhibitor evaluation



WHERE IT APPLIES

Metallurgy & Materials — Materials selection, protective-coating design and failure analysis.

Mechanical & Manufacturing — Component degradation, maintenance and surface protection.

Electrical · E&TC · Instrumentation — Corrosion protection and reliability of metallic components.



IN OUR LABS Cyclic Corrosion Test chamber (Equilam)

THE WORLD OF

Corrosion Engineering

Understand. Prevent. Protect.

Study the mechanisms of corrosion and learn modern techniques to control and prevent material degradation.

Electrochemical Processes
 Protection Strategies
 Corrosion Testing
 Real-World Applications

From corrosion mechanisms to sustainable solutions

How Corrosion Happens

Laboratory Techniques

Potentiostat / Galvanostat (Gamry Interface 1000)
 Cyclic Corrosion Chamber (Equilam)
 Salt Spray Testing (ASTM B117)

Key Learning Outcomes

- Identify corrosion mechanisms and influencing factors
- Evaluate corrosion behaviour using electrochemical and accelerated tests
- Apply protective methods and coatings
- Solve real-world corrosion challenges in industry

Durable Materials for a Sustainable Future

INDUSTRY | INFRASTRUCTURE | CLEAN ENERGY

Fundamentals of Corrosion Engineering

Engineering Science Course (ES-III)

THEORY + PRACTICAL



Why it matters to you?

- Corrosion affects almost every metal structure, machine and infrastructure.
- Leads to huge economic losses and safety risks.
- Understanding and controlling corrosion helps design safer, longer-lasting and sustainable systems.



What you build / learn

- Fundamentals of electrochemistry and corrosion mechanisms.
- Skill in using electrochemical techniques, corrosion testing and surface protection.
- Ability to analyse real-world corrosion problems and suggest solutions.
- Practical exposure through lab experiments and data interpretation.



Placement relevance

- Essential knowledge for industries where materials operate in aggressive environments.
- Relevant for roles in materials, quality control, failure analysis, maintenance and reliability.
- Growing demand in energy, oil & gas, chemical, marine, automotive and infrastructure sectors.



Opportunity pathways

- Corrosion engineer / materials engineer
- R&D in protective coatings and surface engineering
- Inspection and asset integrity management
- Higher studies (M.Tech., Ph.D.) in corrosion, materials degradation and surface science
- Careers in PSUs, private industry and research labs

*Prevent Today.
Protect Tomorrow.*

*Because materials
should last longer.*

FIGHTING CORROSION FOR A STRONGER, SAFER WORLD

From understanding mechanisms to developing solutions



COST SAVINGS
Lower maintenance and longer service life

SAFETY
Prevent failures and accidents

SUSTAINABILITY
Efficient use of resources

GLOBAL OPPORTUNITIES
Wide scope across industries and research

"Engineers don't just build. They protect what matters."

Skills for the Real World



Electrochemical measurement and data analysis



Materials characterisation and surface analysis



Problem solving and design of corrosion protection systems



Technical reporting and standards awareness



Interdisciplinary thinking (materials, chemical, mechanical, civil)

Where can you work?



Oil & gas and petrochemical industry



Marine and offshore structures



Infrastructure (bridges, buildings, pipelines)



Automotive and transportation



Power and energy sector



R&D organisations and academic institutes

A More Durable Tomorrow



By learning corrosion engineering, you contribute to safer infrastructure, cleaner energy, efficient industries and a more sustainable world.

Semester Two

From the nanoscale to high-temperature processing — nanomaterials, and the fuels, furnaces and refractories behind every metal plant.

2

COURSES

6

CREDITS



From the nanoscale to high-temperature processing —

nanomaterials, and the fuels, furnaces and refractories behind every metal plant.



Nanomaterials

Unique structures.
Enhanced properties.



Materials Processing

From powders to products.



Fuels and Energy

Powering high-temperature processes.



Furnaces

High-temperature processing.



Refractories

Withstanding extreme environments.

MATERIALS ACROSS SCALES.
ENABLING A STRONGER TOMORROW.





Nanomaterials

Engineering Science Course (ES-IV)

THEORY

3

CREDITS

WEEKLY STRUCTURE

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EVALUATION SCHEME (100 MARKS)

MSE 30

CIE 20

ESE 50

Theory-only course — no laboratory component



WHAT YOU'LL LEARN

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UNIT 1

Introduction to Nanomaterials

History and scope, bio- and magnetic nanomaterials, surface energy, defects and nanoparticle stability.

2

UNIT 2

Fundamentals of Nanoscience

0D–3D nanostructures, quantum confinement, size-dependent properties, tunnelling, density of states.

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UNIT 3

Synthesis Approaches

Top-down milling, lithography and etching; bottom-up sol-gel, CVD, self-assembly and green synthesis.

4

UNIT 4

Characterisation Techniques

Electron microscopy (SEM, TEM, AFM), spectroscopy (XRD, UV-Vis, FTIR, Raman) and DSC / TGA.

5

UNIT 5

Applications

Nanostructured steels and coatings, batteries and solar cells, water purification, drug delivery, MEMS / NEMS.

6

UNIT 6

Ethics, Safety & Society

Nanotoxicology and safety, sustainability and circular economy, regulation, AI in nanotechnology.



Nanomaterials

In practice — key techniques, career value and where this course takes you

THEORY



TECHNIQUES YOU'LL STUDY

SEM

TEM

AFM

XRD

UV-Vis

FTIR

Raman

DSC

TGA

SEM, XRD, FTIR, UV-Vis, DSC and TGA instruments are all housed in our department.



WHERE IT APPLIES

Metallurgy & Materials — Nanostructured metals, coatings and composites.

Mechanical & Manufacturing — Advanced materials and surface engineering.

Electrical & E&TC — Functional materials, sensors, nanoelectronics.

Civil — Advanced construction materials and coatings.

CSE • Robotics & AI — Materials data, simulation and AI-enabled research.



IN OUR LABS X-Ray Diffractometer (Bruker D8 Advance)



IN OUR LABS Simultaneous DSC-TGA (Linseis STA 1600)

Nanomaterials

Engineering Science Course (ES-IV)

THEORY

Advanced Nanomaterials. Real-World Impact.



Why it matters to you?

- Nanomaterials have unique size-dependent properties that open up new possibilities beyond conventional materials.
- Enable next-generation technologies in energy, electronics, medicine and environment.
- Help you understand and design materials for real global challenges.



What you build / learn

- Understand advanced synthesis routes (chemical, physical and green methods).
- Study structure-property relationships at the nanoscale.
- Learn characterisation techniques (XRD, SEM, TEM, AFM, UV-Vis, FTIR).
- Explore functional nanomaterials for electronics, energy, healthcare and environment.



Placement relevance

- High demand in R&D, advanced materials, electronics, energy, biomedical and sustainability sectors.
- Relevant for roles in materials development, characterisation, quality control and process optimisation.
- Valuable for higher studies (M.Tech., Ph.D.) in India and abroad.

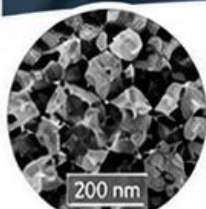
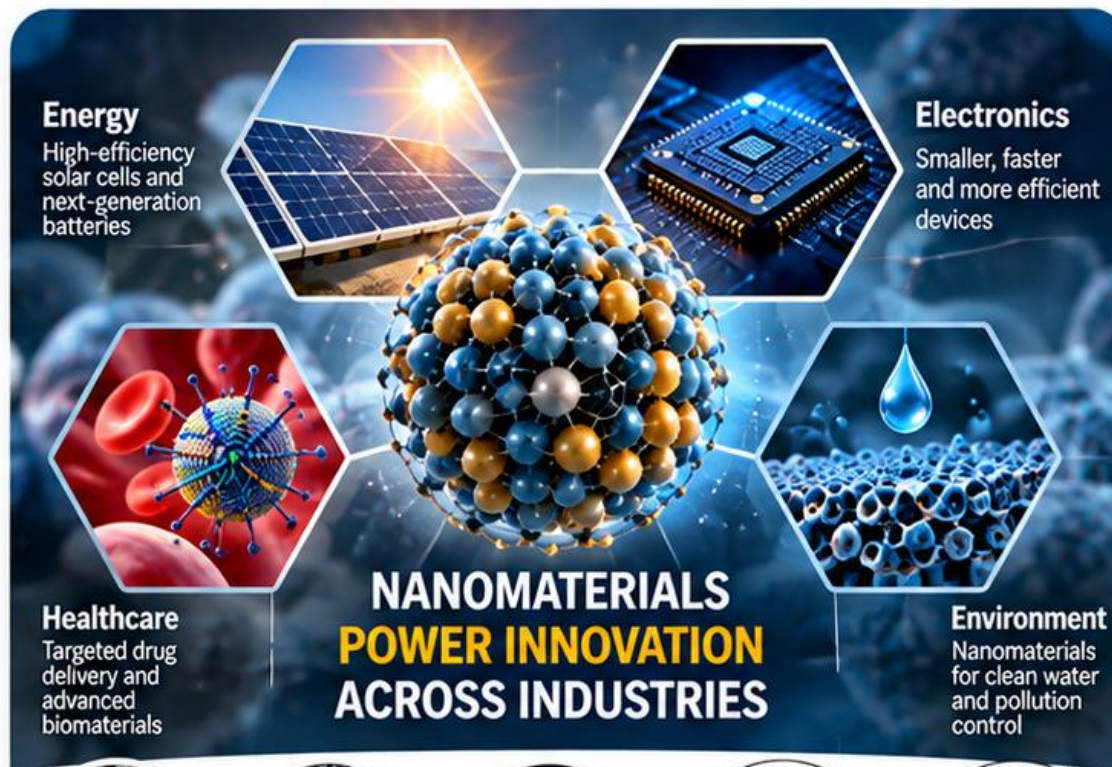


Opportunity pathways

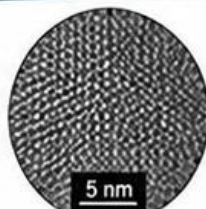
- R&D in functional and smart materials
- Semiconductor and electronics industry
- Energy storage and conversion
- Biomedical and healthcare materials
- Environmental and sustainability solutions
- Start-ups and innovation-driven ventures

*Small Materials.
Big Possibilities.*

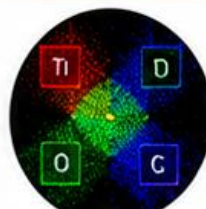
*From the Nanoscale
to a Brighter Future.*



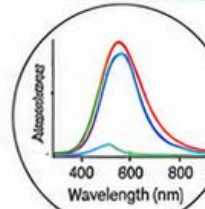
Nanoscale
Particles (SEM)



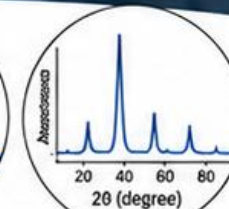
Atomic Structure
(TEM)



Elemental Mapping
(EDS)



Optical Response
(UV-Vis)



Crystal Structure
(XRD)

"Nanoscale Ideas. Real-World Solutions."

Skills for the Real World



Materials synthesis and processing



Advanced characterisation and data analysis



Innovative and design-oriented thinking



Interdisciplinary and team-based problem solving

Where can you work?



Semiconductor and electronics companies



Energy and clean technology sector



Biomedical and pharmaceutical industry



Environmental and sustainability sector



Advanced materials and coatings industry



Higher studies and research
(in India and abroad)

Shape a Better Tomorrow



Nanomaterials help build cleaner energy, healthier lives, smarter devices and a greener planet. By learning nanomaterials, you become part of the solution for a more innovative and sustainable future.



Fuels, Furnaces and Refractories

Programme Core Course (PCC) • Compulsory

THEORY + LAB

3

CREDITS

WEEKLY STRUCTURE

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EVALUATION SCHEME (100 MARKS)

MSE 30

CIE 20

ESE 50

+ Laboratory: continuous internal evaluation — fuel, furnace and refractory-testing experiments, journal and viva-voce



WHAT YOU'LL LEARN

1

UNIT 1 Fuels

Solid, liquid and gaseous fuels; coal grading, proximate / ultimate analysis, calorific value, combustion.

2

UNIT 2 Carbonization of Coal

Coking vs non-coking coals, metallurgical coke; producer, water, blast-furnace and coke-oven gas.

3

UNIT 3 Furnaces

Fuel-fired heating furnaces and accessories; salt-bath, pit-type, fluidised-bed and sintering furnaces.

4

UNIT 4 Combustion Calculations

Excess air, furnace atmospheres, heat and radiation losses, thermal efficiency, waste-heat recovery.

5

UNIT 5 Electric Arc & Resistance Furnaces

Arc and induction furnaces, skin effect, frequency and power calculations, resistance heating.

6

UNIT 6 Refractories

Fireclay, silica, magnesite and chrome refractories — manufacture, testing, failure and selection.



Fuels, Furnaces and Refractories

In practice — hands-on skills, career value and where this course takes you

THEORY + LAB



HANDS-ON IN THE LAB

Fuel-oil viscosity

Flash & fire point

Proximate analysis of coal

Calorific value

Thermocouple calibration

Heating elements & furnace parts

Refractory packing density

Spalling resistance

Muffle-furnace design study



IN OUR LABS DSC-TGA (Linseis STA 1600)



WHERE IT APPLIES

Metallurgy & Materials — Compulsory Semester II core — every Metallurgy student completes it.

Mechanical & Manufacturing Science — Heat-treatment and furnace-based processes.

Other engineering branches — Combustion and process-heat fundamentals.

Offered as a Metallurgy branch-mandatory subject.



Fuels, Furnaces and Refractories

Programme Core Course (PCC)

THEORY + LAB

Energy. High Temperatures. Stronger Industries.



Why it matters to you?

- High-temperature processing is central to metals, ceramics, energy and advanced materials.
- Fuels and furnaces enable efficient, safe and cost-effective production.
- Refractories are the backbone of industries working at extreme temperatures.
- Knowledge of energy, environment and sustainability is essential for future engineers.



What you build / learn

- Understand fuels, combustion and thermodynamics.
- Learn furnace design, heat transfer and process control.
- Study refractory materials, their properties, selection and failure mechanisms.
- Gain hands-on experience through high-temperature experiments and thermal analysis.
- Develop skills for energy-efficient and sustainable processing.



Placement relevance

- Relevant to core industries: steel, cement, glass, ceramics, refractories, foundries, non-ferrous metals and energy.
- Growing opportunities in thermal processes, energy management and sustainable technologies.
- Useful for process, production, quality and R&D roles.
- Valuable for higher studies (M.Tech., Ph.D.) in high-temperature materials and processing.



Opportunity pathways

- Process and production engineering
- Refractory and ceramic industry
- Energy and power sector
- Cement, glass and foundry industries
- R&D and materials development
- Higher studies and research
- Careers in PSUs, private industry and startups

*High Temperatures
Build a Better Tomorrow.*

*From Fuels to
Furnaces to a
Sustainable Future.*

HIGH TEMPERATURE SOLUTIONS FOR A STRONGER, CLEANER WORLD

Fuels · Furnaces · Refractories · Sustainable Processing

**Transforming
Raw Materials
into a Better
Tomorrow**

Metals & Alloys

Glass & Ceramics

Energy Materials

Advanced Materials

Sustainable Industry

Fuels & Combustion
From fuels to heat
with higher efficiency

Industrial Furnaces
Design, heat transfer
and process control

Refractory Materials
Withstand extreme
temperatures

Thermal Analysis
Measure, monitor
and optimise

Sustainable Processing
Cleaner processes
for a greener future



HIGHER
PROCESS EFFICIENCY



COST
OPTIMISATION



SAFER
OPERATIONS



LOWER
ENVIRONMENTAL IMPACT



A MORE
SUSTAINABLE FUTURE

“High Temperatures Create Materials. Smart Engineers Create Possibilities.”

Skills for the Real World



Combustion and energy analysis



Heat transfer and thermal design



Refractory selection and performance
evaluation



Process control and thermal modelling



Sustainability and emission reduction



Interdisciplinary problem solving

Where can you work?



Steel and non-ferrous metal industries



Cement, glass and ceramics industries



Foundries and casting industries



Power and energy sector



Environment and sustainability sector



R&D organisations and academic institutes



Process, production and quality roles

Powering a Sustainable Future



By understanding fuels, furnaces and refractories, you enable efficient resource use, cleaner energy, critical materials production and a more sustainable industrial future. This knowledge is essential for a low-carbon, resilient and technology-driven world.

Structure and Properties of Materials

Know the structure. Predict the behaviour. Design better materials.



Why it matters?

- Foundation for all materials engineering.
- Helps you understand why materials behave the way they do.
- Essential for selecting and designing materials for real applications.



What you build?

- Ability to analyse structure-property relationships.
- Hands-on testing and characterisation skills.
- Confidence to interpret mechanical, electrical, thermal and optical behaviour.



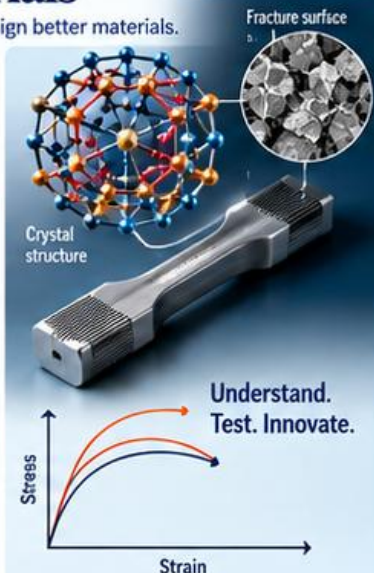
Placement relevance

- Used in quality control, failure analysis, R&D and materials design.
- Relevant for core and multidisciplinary roles in manufacturing, automotive, aerospace, energy and infrastructure sectors.



Opportunity pathways

- Higher studies (M.Tech., Ph.D.)
- R&D and materials characterisation (e.g., nano-composites, nano-coatings).
- Product development and failure analysis
- Career roles in core and allied industries



Materials knowledge turns ideas into reliable products.

"From atoms to real-world performance."

Nanomaterials

Small dimensions. Big possibilities.



Why it matters?

- Unique properties at the nanoscale optical, electrical, mechanical, catalytic.
- Key to next-generation technologies.
- Important for clean energy, electronics, healthcare and environment.



What you build?

- Understanding of synthesis, processing and characterisation of nanomaterials.
- Ability to relate nanoscale structure to properties.
- Skills in analysing real characterisation data (XRD, SEM, etc.).



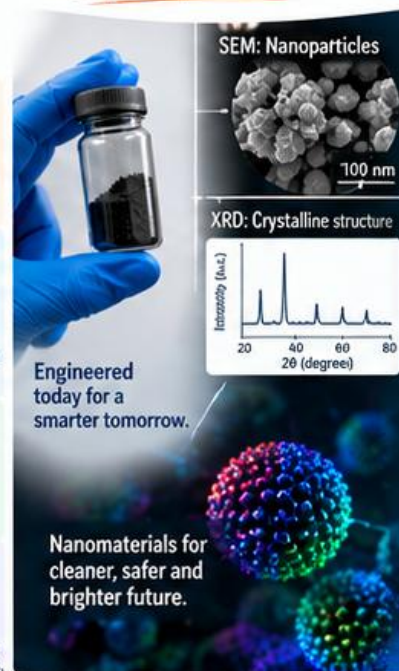
Placement relevance

- Relevant for R&D, advanced materials, electronics, energy, biotechnology and nanotechnology industries.
- Opportunities in both core and multidisciplinary sectors.



Opportunity pathways

- Higher studies and research in nanoscience and nanotechnology.
- Product and process development.
- Roles in advanced materials, electronics, pharma, energy and environmental sectors.



At the nanoscale, new opportunities emerge.

"Explore the nanoscale. Shape the future."

Fundamentals of Corrosion Engineering

Prevent today. Protect tomorrow.



Why it matters?

- Corrosion affects safety, cost and sustainability.
- Essential to ensure longer service life of materials and structures.
- Highly relevant for industries and infrastructure.



What you build?

- Understanding of corrosion mechanisms and protection methods.
- Hands-on skills in electrochemical testing, coatings and corrosion monitoring.
- Ability to analyse and solve real corrosion problems.



Placement relevance

- Relevant for core industries (steel, oil & gas, chemical, power, marine, infrastructure).
- Opportunities in inspection, asset integrity, coatings and materials selection.



Opportunity pathways

- Higher studies in corrosion science, materials protection and surface engineering.
- Roles in inspection, maintenance and failure analysis.
- Careers in energy, process and infrastructure industries.

"Understand corrosion. Build a more durable world."



Nanomaterials (Advanced)

From fundamentals to functional applications.



Why it matters?

- Builds on fundamental concepts to explore advanced nanomaterials and applications.
- Important for emerging technologies in energy, electronics, sensors and biomedical fields.
- Develops innovation and research mindset.



What you build?

- Understanding of advanced synthesis techniques.
- Exposure to functional nanomaterials (e.g., nano-composites, nano-coatings).
- Ability to analyse and present scientific literature.



Placement relevance

- Relevant for R&D roles in advanced materials, electronics, energy, biotech and environmental sectors.
- Opportunities in high-tech and start-up ecosystems.



Opportunity pathways

- Higher studies (M.Tech., Ph.D.) in nanomaterials and related areas.
- Research and product development.
- Careers in advanced materials, energy storage, sensors, biomedical and environmental applications.



Smaller materials. Greater impact.

"Turn nanoscience into real-world solutions."

Fuels, Furnaces and Refractories

High temperatures. Higher possibilities.



Why it matters?

- High-temperature processes are central to metallurgy and materials manufacturing.
- Fuels, furnaces and refractories enable efficient, safe and sustainable production.
- Essential for energy, materials and environmental sustainability.



What you build?

- Understanding of fuels, combustion and heat transfer.
- Knowledge of furnace design and operation.
- Ability to select and evaluate refractory materials.
- Exposure to industrial practices and energy efficiency.



Placement relevance

- Relevant for steel, cement, non-ferrous, glass, ceramic, power and process industries.
- Opportunities in process engineering, plant operations, energy management and refractory design.



Opportunity pathways

- Higher studies in high-temperature materials, process metallurgy and energy systems.
- Roles in plant design, operations, energy efficiency and sustainability.
- Careers in core industries and consulting.



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