

M.Tech Production Engineering 2nd year (3rd semester)

Title of Course: Nanotechnology
L-T Scheme: 3-0

Course Code: PE301
Course Credits: 3

Introduction:

This course brings together relevant knowledge from the disciplines of physics and mechanical engineering to give you a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology. Introduction to Nanotechnology aims to provide a broad overview of fundamental principles and current research directions in nanoscience and nanotechnology.

Objectives:

1. The student will have broad knowledge in the chosen discipline, with deep knowledge in its core concepts.
2. To enhance the knowledge in at least one discipline other than your primary discipline and some understanding of interdisciplinary linkages.
3. The student can demonstrate well-developed problem solving skills, applying their knowledge and using your ability to think analytically and creatively.
4. It develops a capacity for independent and self-directed work.

Course Outcomes:

After successfully completing this course, you should be able to:

CO1: Describe the basic science behind the properties of materials at the nanometre scale

CO2: Study advanced experimental and computational techniques for nanomaterials.

CO3: Communicate clearly, precisely and effectively using conventional scientific language and mathematical notation.

CO4: Systematically solve scientific problems related specifically to nanotechnological materials

CO5: Use conventional scientific and mathematical notation in nanotechnological terms.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	3	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	3	-	3	-	-	3	-	1
CO4	3	3	3	3	-	3	-	-	3	-	3
CO5	3	2	3	3	-	3	-	-	3	-	3

3 - High; 2 - Medium; 1 - Low

Course Contents:

UNIT 1

The Canvas of Nano: Nano and Nature; Our Technologies and the world we live in;

Nano – The Beginning.

UNIT 2

Investigating and Manipulating Materials in the Nanoscale: Introduction; Electron Microscopies; Scanning Probe Microscopies; Optical Microscopies for Nanoscience and Technology; Other Kinds of Microscopies; X-Ray Diffraction; Associated Techniques.

UNIT 3.

Fullerenes: Introduction: Discovery and Early year; Synthesis and Purification of Fullerenes; Mass Spectrometry and Ion/Molecule Reaction; Chemistry of Fullerenes in the Condensed Phase; Endohedral Chemistry of Fullerenes; Orientation Ordering; Pressure Effects; Conductivity and superconductivity in doped fullerenes; ferromagnetism in C₆₀ TDAE.

UNIT 4.

Carbon Nanotubes: Introduction; Synthesis and Purification; Filling of Nanotubes; Mechanism of Growth; Electronic Structure; Transport Properties; Mechanical Properties; Physical Properties; Applications; Nanotubes of other Materials.

UNIT 5.

Nanoshells: Introduction; Types of Nanoshells; Properties; Characterization; Application.

UNIT 6.

Nanosensors: Introduction; what is a Sensor?; Nanosensors – what make them possible?, Order from Chaos – Nanoscale Organization for Sensors; Characterization – To know what has been put in; Perception – Nanosensors based on optical properties, Nanosensors based on Quantum size Effects; Electrochemical Sensors; Sensors based on physical properties; Nanobiosensors- A step towards Real- time Imaging and Understanding of Biological Events; Smart Dust – Sensors of the Future.

TEXT BOOKS:

1. Robert K, Ian H, Mark G, Nanoscale Science and Technology, John Wiley & Sons Ltd., 2005
2. S. N. Sahu, R. K. Choudhury, and P. Jena, Nano-scale Materials: From Science to Technology, Nova Science Publishers, 2006.

REFERENCES:

1. Patankar, S. V., Numerical Heat Transfer and Fluid Flow, Hemisphere, 1980.
2. Bowley, R., and Sanches, M., Introductory Statistical Mechanics, 2nd Edn., Oxford Science Publications, 2007.
3. B.D. Agarwal and L.J. Broutman, "Analysis and Performance of Fibre Composites", John Wiley & Sons Inc.
4. Daniel V. Schroeder: An Introduction to Thermal Physics, Addison-Wesley, 2000

Title of Course: Advanced Welding Technology

Course Code: PE302

L-T Scheme: 3-0

Course Credits: 3

Introduction:

Materials (mild steel, stainless steel, aluminum, cast iron, etc.) and their behavior during welding. Welding (different types for different welding processes, materials) Metrology, standards and documentation..

Objectives:

1. Evaluate potential hazards and apply procedures to maintain workplace safety; demonstrate appropriate safe work habits when operating ox fuel, plasma and electric welding equipment and function safely in a welding environment.
2. Select and operate tools and equipment to support welding and related activities.
3. Read and interpret basic blueprints and welding symbols to fabricate components.
4. Perform Shielded Metal Arc Welding to industry standards and pass the AWS D1.1 Structural Unlimited Certifications.
5. Perform Gas Metal Arc Welding to industry standards.
6. Perform Flux Core Welding to industry standards and pass the AWS D1.1 Structural Unlimited Certifications.

Course Outcomes:

After successfully completing this course, you should be able to demonstrate:

- CO1: Deeper knowledge of materials technology of welding:
- CO2: Deeper knowledge of different metals and their properties in welded constructions
- CO3: Knowledge of current computer systems and cost for welding operations
- CO4: Knowledge of applications of strength of materials on welded constructions
- CO5: Applications of fracture mechanics on welded constructions, pressure vessels etc.
- CO5: Ability to perform design calculations on a welded component
- CO6: Ability to analyse defect tolerance of a casualty critical construction

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3		-	-	-	3	-	-	-	-	3
CO2	3		3	-	-	-	-	-	-	-	3
CO3	3	3	3	3	-		-	-	-	3	3
CO4	3	3	3	2	-	3	-	-	-	3	1
CO5	3	3	3	3	-		-	-	3	3	3

3 - High; 2 - Medium; 1 - Low

Course Contents:

UNIT I

Analysis of heat sources for welding, Mechanism of metal transfer and solidification of fusion weldments. Thermal stresses and distortion in welded structure. Mechanism of solid state

joining process.

UNIT II

Parameters in welding and their control, analysis of 2D, 3D heat flow in welds. Modern welding process like EBW, LBW, Diffusion bonding. Ultrasonic welding etc. Pulsed current welding processes.

UNIT III

Welding of Ceramics, Plastics and Composites. Weldment design for pressure vessels. Off-shore structures and Submarine Pipe lines. Heavy structures, Failure of welds. NDT of welds. Inspection codes for weldments.

TEXT BOOKS:

1. O.P. Khanna, A Text Book of Welding Technology, Dhanpat Rai & Sons.
2. R.S. Parmar, Welding Engineering and Technology, Khanna Publishers.
3. M. Bhattacharyya, Weldment Design, The Association of Engineers, India Publication, Kolkata.

REFERENCES:

4. J.C. Lippold and D.J. Kotecki, Welding Metallurgy and Weldability of Stainless Steels, Wiley-India (P) Ltd., New Delhi.
5. Udin, Funk and Wulf, Welding for Engineers, John Wiley and Sons.
6. J.L. Morris, Welding Process and Procedures.
- 7.. S.V. Nadkarni, Modern Arc Welding Technology, Oxford & IBH Publishing Co. Pvt. Ltd./ Advani-Oerlikon Ltd.

Title of Course: SEMINAR-I

Course Code: PE391

L-T-P Scheme: 0-2-0

Course Credits: 1

In II year III semester, a seminar presentation of project proposal shall be done by Supervisor for 1 credit.

The Supervisor along with department's member will examine the Problem Definition, Objectives, Scope of Work and design of Project via presentation in seminar. A candidate shall secure a minimum of 40% to be declared successful in Seminar-I presentation. If candidate fails to fulfill minimum marks, he has to reappear during the supplementary examination.

Title of Course: Project-Part I

Course Code: PE392

L-T-P Scheme: 0-0-12

Course Credits: 12

In II year III semester, a project work review shall be done by Supervisor for 12 credit. The evaluation for the project reviews shall be done in 4 stages (not less than 4 weeks between two consecutive stages) including end semester evaluation.

The Supervisor and internal examiner along with department's member will examine the Problem Definition, Objectives, Scope of Work and design of Project via presentation in seminar. A candidate shall secure a minimum of 50% to be declared successful in Seminar-I presentation. If candidate fails to fulfill minimum marks, he has to reappear during the supplementary examination.