

Department of Nanoscience and Technology

Revised Syllabus of Diploma Courses (UG) I Year

Preamble:

Diploma in Industrial Nanotechnology is three years integrated course for under graduate students. The students from B.Sc. Nanoscience and Technology should be competent about specific Laboratory Skills require for industries based on nanotechnology.

In this Diploma course students will be able to understand the various ways of synthesizing nanomaterials, enhancing the properties of nanomaterials according to industrial product requirement and implementing the same for specific application.

Program Objectives of the Course:

- 1) To enhance the student's practical knowledge.
- 2) To develop laboratory skills as per industrial requirement.
- 3) To make them able to use synthesized nanomaterials in specific application

Program Outcomes:

- 1) Students should able to prepare nanomaterials by various methods.
- 2) Students should able to analyze physical, chemical and biological properties of materials.
- 3) Students should able to make applications of nanomaterials

Diploma Course (I Year)

1. Title: Industrial Nanotechnology
2. Year of Implementation: 2020
3. Duration: One Year
4. Pattern: Annual
5. Medium of Instruction: English
6. Contact hours: 7 hours/week for I Year.
8. Structure of Course: **For UG**

Year	Semester	Paper No.	Paper Code	Contact Hours	Credits (1Credid =12H)	Marks		
						Semester/ Annual Exam	Internal	Total
1	I	PT I	DPT 101	30	2.5	50	15	65
	II	PT II	DPT 202	30	2.5	50	10	60
		PL I	DPL101	120	5	100	25	125
		PP I	DPP101	30	2.5	50	-	50
	Total			210	12.5	250	50	300
2	III	PT III	DPT 301	30	2.5	50	15	65
	IV	PT IV	DPT 402	30	2.5	50	10	60
		PL II	DPL202	120	5	100	25	125
		PP II	DPP202	60	5	100	-	100
	Total			240	15	300	50	350
3	V	PT V	DPT 501	30	2.5	50	15	65
	VI	PT VI	DPT 502	30	2.5	50	10	60
		PL III	D PL 303	120	5	100	25	125
		PP III	DPP 303	60	5	100	-	100
	Industrial/Incubati on Training			10	1	-	-	-
	Total			250	16	300	50	350
Total			700	43.2	850	150	1000	

Total No. of Papers: Theory: 6, Practical: 3, Project:3

Number of Lectures per week: 07

Theory: Semester, Practical and Project: Annual

PT: Paper Theory, PL: Paper Lab, PP: Paper Project, D: Diploma, * : Name of Subject, T : Theory, L: Lab, P: Project

DPT 101:

(Contact Hrs: 30 Credits: 2.5)

Learning Objectives:

- 1) To provide industrial approach for synthesis nanomaterials
- 2) To provide knowledge of Physical Methods of Nanomaterial Synthesis

Unit I:

(15)

Introduction, top down and bottom up approach, classification of synthesis methods. Nucleation and growth process nanomaterials

Unit II: (15)

Hydrothermal Process, Solvothermal Process, Sol-gel process: Steps for sol formation, gel formation, Sol gel coating. Spray Pyrolysis, SILAR technique

Learning Outcomes:**Unit I: After completion of the unit, Student is able to**

1. Explain Top down and bottom up approach of synthesis
2. Classify synthesis process
3. Know Nucleation and growth mechanism

Unit II: After completion of the unit, Student is able to

1. Explain Hydrothermal Process and Solvothermal Process
2. Explain Sol-gel process
3. Explain Spray Pyrolysis
4. Explain SILAR technique

DPT 102**(Contact Hrs: 30 Credits: 2.5)****Learning Objectives:**

- 1) To learn Chemical Methods of Nanomaterial Synthesis
- 2) To learn Biological Methods of Nanomaterial Synthesis

Unit I: (15)

Chemical vapor deposition (CVD): Types of CVD process,
Physical vapor deposition technique
Electro-deposition technique

Unit II: (15)

Biological Methods of Nanomaterial Synthesis: Hot and cold extraction methods, Introduction, principle and working, construction of soxhlet apparatus and Rotary evaporator advantages and uses. Characterization of isolated extract via different methods.

Learning Outcomes:**Unit I: After completion of the unit, Student is able to**

1. Explain Chemical vapor deposition (CVD)
2. Explain Physical vapor deposition technique
3. Explain Electro-deposition technique

Unit II: After completion of the unit, Student is able to

1. Explain hot and cold extraction methods
2. Explain working of soxhlet apparatus

3. Explain working of Rotary evaporator

Reference Books:

1. Nanotechnology: Principles and Practices by S. K. kulkarani, Capital publish, 3rd edition, 2014.
2. Introduction to Nanomaterials and nanotechnology by Vladimir Pokropivny, Rynn Lohmus, Irina Hussainova, Alex Pokropivny and Sergey Vlassov, Tartu University Press, 2007.

**DPL101: (Practical):
(Contact Hrs: 120 Credits: 05)**

Learning Objectives:

- 1) To learn different techniques for synthesis of nanoparticles
- 2) Gain knowledge in optimization of reaction conditions for synthesis of nanomaterials
- 3) Know the synthesis of nano-particals by using biological material.
- 4) To learn the various Extraction methods of nanoparticle

List of Practical's (30)

1. Synthesis of CdS thin film by SILLAR method.
2. Synthesis of SnO thin film by SILLAR method.
3. Synthesis of CdS nanoparticles by co-precipitation method.
4. Synthesis of ZnO Nanoparticles by Spray Pyrolysis method
5. Synthesis ofTiO₂ Nanoparticles by Electro-deposition method
6. Synthesis of ZnO Nanoparticles by Sol-gel Method
7. Synthesis of Ferrite Nanoparticles by CBD Method
8. Synthesis of MgO nanoparticles by biological method (plantextract).
9. Synthesis of Ag nanoparticles by biological method (bacteria).
10. Isolation of DNA from the plant source.
11. Isolation of DNA from Bacteria.
12. Isolation of RNA from the plant source.
13. Isolation of RNA from Bacteria.
14. Separation of DNA by agarose gel electrophoresis.
15. Separation of RNA by agarose gel electrophoresis
16. Determination of band gap usingUV.
17. Determination of absorbance Maxima by using UV.
18. To study photo catalytic dye degradation using UV spectroscopy.
19. Identification of compounds by using IR.
20. Identification of surface morphology using SEM image.

21. To calculate concentration of metal nanoparticles using SEM image.
22. To characterize the particle size of CdS material by using SEM images.
23. Determination of crystal structure using X-ray diffraction.
24. Determination of crystalline size using X-ray diffraction.
25. To study the property of X-ray diffraction pattern.
26. Quantification of DNA and RNA by UV
27. Crude drug identification – Moisture content, pH, ash content, extractive values.
28. Use of Separation techniques - TLC, HPTLC.
29. Extraction of volatile oils via extraction methods.
30. Extraction of different compound via cold extraction methods.

Learning Outcomes: Students are able to

- 1) Know principle and working of various synthesis method.
- 2) Have an idea about the growth mechanism of nanomaterials.
- 3) Use different nanoparticles synthesis methods.
- 4) Understand the synthesis of nanoparticle by using plants, fungi.

Reference Books:

1. Nanotechnology: Principles and Practices by S. K. kulkarani, Capital publish, 3rd edition, 2014.
2. Introduction to Nanomaterials and nanotechnology by Vladimir Pokropivny, Rynn Lohmus, Irina Hussainova, Alex Pokropivny and Sergey Vlassov, Tartu University Press, 2007.

DPP101 (Project):
(Contact Hrs. 30, Credits: 2.5)