Department of Nanoscience and Technology

Revised Syllabus of Diploma Program

Program Objectives of the Course:

1) To develop laboratory skills of students as per industrial requirement.
2) To enhance the technical knowledge of students.
3) To increase the employability opportunities for the students.
4) To promote entrepreneurship skills among the students.

Program Outcomes:

After successful completion of this Diploma Program students will be able to

1) Develop technical skills required for Nanotechnology based industries.
2) Understand the product development in nanotechnology.
3) Get knowledge of self-employability.
4) Develop entrepreneurial skills.

II Year Diploma Programme

1. Title: Industrial Nanotechnology
2. Year of Implementation: 2021
3. Duration: One Year
4. Pattern: Semester
5. Medium of Instruction: English
6. Contact hours: 7 hours/week
8. Structure of Course:

Syllabus Structure (UG)

Year	Semester	Course No.	Course Code	Contact Hours	Credits (1Credit=15 H)	Total Marks
1	I	CT I	DNTT 101	30	2	75
		CL I	DNTL101	60	2	75
	II	CT II	DNTT 202	30	2	75
		CL II	DNTL202	60	2	75
	Annual	CP I	DNTP101	30	1	50
			Total	**210**	**9**	**350**

Year	Semester	Course No.	Course Code	Contact Hours	Credits (1Credit=15 H)	Total Marks
2	III	CT III	DNTT 303	30	2	75
		CL III	DNTL303	60	2	75
	IV	CT IV	DNTT 404	30	2	75
		CL IV	DNTL404	60	2	75
	Annual	CP II	DNTP202	30	1	50
	Industrial and or Incubation and or Research and or Field Training			30	1	-
			Total	**240**	**10**	**350**
	V	CT V	DNTT 505	30	2	75
		CLV	DNTL505	60	2	75
	VI	CT VI	DNTT 606	30	2	75
		CL VI	DNTL606	60	2	75
	Annual	CP III	DNTP303	60	2	100
	Industrial and or Incubation and or Research and or Field Training			30	1	-
			Total	**270**	**11**	**400**
Total				**720**	**30**	**1100**

C: Course, T: Theory, L: Lab (Practical), P: Project

Total No. of Courses: 15 (Theory: 06, Practical: 06, Project: 03)

Theory and Practical: Semester, Project: Annual

Semester III

DNTT 303: Thin film Sensor Technology
(Contact Hrs: 30 Credits: 2)

Learning Objectives:

Students will be able to

1) Get aware about thin film sensor technology.
2) Understand the industrial applications of sensors.

Unit I Nanosensors: (15)

Introduction to sensors. Characteristics and terminology - static and dynamic characteristics. Micro and Nano--sensors, Fundamentals of sensors, biosensor, micro fluids, Packaging and characterization of sensors, Sensors for aerospace and defense. Organic and inorganic Nano- sensors.

Unit II Nanotechnology enabled devices: (15)

Nanomaterials and nanostructured films, Nanoscale electronic and ionic transport. Sensor for bio-medical applications. Nanoparticle-biomaterial hybrid systems for sensing applications. Gas sensor.

Learning Outcomes:

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

1. Understand types of Sensors
2. Uses of sensors

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

1. Understand properties of Nanoscale electronics
2. Understand Nanosturcture films and its properties
3. Understand various opportunities in applications of bio- sensors Explain SILAR technique

Reference Books:

1. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester, 2002.
2. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004.
3. Nanomaterials for Biosensors, Cs. Kumar, Wiley – VCH, 2007.
4. Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006.

DNTL303: **(Practical):**
(Contact Hrs: 60 Credits: 02)

Learning Objectives:

Students will be able to

1) Understand properties for thin film
2) Understand various Optical properties of thin films.
3) Understand various Electrical properties of thin films.
4) Understand calibration of sensor.

List of Practical's (15)

1. Deposition of thin films using SILAR method on glass substrate-I
2. Deposition of thin films using SILAR method on glass substrate.-II
3. Deposition of thin films using CBD glass substrate-I
4. Deposition of thin films using CBD glass substrate.-II
5. Deposition of thin films using SILAR method on silica substrate.
6. Deposition of thin films using CBD silica substrate.
7. Study Physical properties of thin film.
8. Optical properties of thin film (Transmittance)
9. Optical properties of thin film (Absorbance)
10. Optical properties of thin film (band gap)
11. Morphological characterization of thin film by using SEM
12. Electrical properties of thin film (Resistivity)
13. Electrical properties of thin film (Conductivity)
14. Calibration of sensor (Sensitivity and Stability)
15. Study Biosensor for medical diagnosis.

Learning Outcomes:

After completion of the practical, Student is able to

1) Develop skill for measuring physical, optical and electrical properties of sensor.
2) Get technical knowledge of thin films synthesis for sensor applications
3) Develop basic skills required for sensor development.

Reference Books:

1. A Laboratory Course in Nanoscience and Nanotechnology by Dr. Gerrard Eddy Jai Poinern; CRC Press, Taylor and Francis Group, 2015.

Semester IV

DNTT 404: Biosensor
(Contact Hrs: 30 Credits: 2)

Learning Objectives:

Students will be able to

1) Get knowledge about biosensor
2) Understand the applications of biosensor.

Unit I Introduction to Biosensors: (Lecture 15)

Definitions, biological inspiration, types of sensors, target analytes, various recognition, Recognition event : Catalytic, Single and multiple enzyme, Bio Affinity: Labeled and Label free, whole cell sensing – bacteria, yeast, mammalian cell, Generation of Biosensor; Biomolecule Immobilization Techniques, Enzyme Kinetics

Unit II Applications of Biosensors: (Lecture 15)

Biosensors and diabetes management, Microfabricated biosensors and point-of-care diagnostics systems, Noninvasive biosensors in clinical analysis; Surface plasmon resonance and evanescent wave biosensors, Biological MEMS materials

Learning Outcomes:

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

1. Explain parts of biosensor
2. Know Bio Affinity
3. Know generation of biosensor

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

1. Explain biosensors in clinical analysis
2. Explain Biological MEMS material
3. Explain application of biosensor in diagnostics systems

Reference Books:

1. Introduction to Biosensors by Jeong-Yeol Yoon; Publisher: Springer-Verlag New York Ed.1
2. Recognition Receptors in Biosens.by Mohammed Zourob; Publisher: Springer-Verlag New York Ed.1
3. Novel Approaches in Biosensors and Rapid Diagnostic Assays by Zvi Liron; Publisher: Springer US Ed.1

DNTL404: **(Practical):**
(Contact Hrs: 60 Credits: 02)

Learning Objectives:

Students will be able to

1. Understand techniques MEMS
2. Understand various characteristics of transducers.
3. Understand BioMEMS.
4. Understand immobilization method.

List of Practical's (15)

1. To study about various static and dynamic characteristics of Transducers.
2. To study about Electrochemical & optical Transduction.
3. Introduction to various types of Biosensors.
4. To study about different types of Force Measurement Techniques.
5. To study about different types of Torque Measurement Techniques.
6. Introduction to Bio-MEMs.
7. To study about various fabrication techniques of BioMEMs.
8. Immobilization methods (i) Absorption (ii) Covalent Binding (iii) Entrapment
9. Study of alcohol based Biosensor
10. Study of Glucose based biosensor
11. Study of enzyme based biosensor
12. Study of DNA based biosensor
13. Study of mechanism and action of voltametric DNA biosensor
14. Study of Graphene based Electrochemical DNA biosensor.
15. Validation study of paper based biosensor for detecting pesticides

Learning Outcomes:

After completion of the practical, Student is able to

1. Develop skill for Electrochemical & optical Transduction
2. Get technical knowledge of MEMS
3. Develop basic skills required for biosensor.

Reference Books:

1. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester, 2002.
2. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004..