GUJARAT TECHNOLOGICAL UNIVERSITY
NANO TECHNOLOGY
SUBJECT NAME: THIN FILM TECHNOLOGY
SUBJECT CODE: 2173903
B.E.7th SEMESTER

Type of course: Physics, Nanomaterial, Coating Technology, Synthesis of Nanomaterials, Characterisation of Nanomaterial, Chemistry.

Prerequisite: Basic knowledge of Nanomaterials, Synthesis of Nanomaterials

Rationale: To make the students understand the technique to prepare a nano thin films and device.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	4	7	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**INTRODUCTION** Basic of Thin films and Nanostructures, Role of thin films in Devices.	9	18%
2	**FABRICATION OF THIN FILMS** Sol-gel synthesis, Spin coating, Chemical vapor deposition, Physical vapor deposition, Sputtering deposition, ion implantation, Cathodic arc deposition, Pulsed laser deposition, Molecular beam epitaxy	12	21%
3	**CHARACTERIZATION OF THIN FILMS** x-ray diffraction, UV-vis spectroscopy, squid, four probe resistivity, atomic probe microscopy, profilometer	9	20%
4	**PROPERTIES OF THIN FILMS** Structural, electrical, magnetic, optical, thermal, etc.	9	21%

5	**APPLICATION OF THIN FILMS** Application of thin films in different areas such as electronics, medical, defense, sports, automobiles, etc.	9	20%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	Understanding U Level	Application A Level	Analyze N Level	Evaluate E Level
18	25	25	12	20

Legends: R: Remembrance; U = Understanding; A = Application and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
2. W.T.S. Huck, "Nanoscale Assembly: Chemical Techniques(Nanostructure Science and Technology)",

3. Thin Film Phenomena by K. L. Chopra, McGraw Hill 1969.

Course Outcome:

After learning the course the students should be able to:

1. To notify the learner about the various techniques of nano-thin films.

2. To know about the growth of nanostructured thin films.

3. To have knowledge about synthesis of nanostructured thin films

LIST OF EXPERIMENTS:

1. Dip coating of a poly thin film on glass substrates
2. Deposition of the metal (Al) thin film on glass substrates by spin coating method
3. To deposit polymer thin film by spin coating technique

4. To measure D.C. resistivity of thin film by four Probe method
5. Annealing study of thin films at different temperature
6. Study of composition variation in synthesis of thin films
7. To measure optical bandgap of a thin film using absorption and transmission spectra.

Design based Problems (DP)/Open Ended Problem:
Open Ended /design based project: Apart from above experiments, a group of students (Maximum Three) has to undertake one open-ended problem/design problem. (Students are free to select any area of science and technology may be based on their branch to define the project)

Aims:
1. To provide experience in laboratory-based experimentation, data recording and analysis and drawing of conclusions.
2. To develop report writing skills for scientific material
3. To develop the ability to undertake investigations where, as part of the exercise, the goals and methods have to be defined by the investigator.
4. To develop skills in literature searches and reviews.

Evaluation of Open-ended / design based small project:

1. Open ended / design based small project will be evaluated by the external examiner with appropriate marks allotment given by GTU time to time.
2. Faculties should cultivate problem-based project to enhance the basic mental and technical level of students.
3. Evaluation should be done on the approach of the student on his/her efforts (not on completion) to study the design module of given task.

Examples:

1. Fabrication of thin films
2. Characterization of thin films.

Major Equipment:

1. Distil Water Unit
2. PH Meter
3. Spin coater
4. I-V measurement setup
5. Furnace

List of Open Source Software/learning website:

http://ocw.mit.edu/courses/

www.nptel.ac.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.