



Course Syllabus  
Gyanmanjari Science college  
Semester-2 (B.Sc.)

**Subject:** Nanotechnology - BSCXX12307

**Type of course:** Multidisciplinary

**Prerequisite:** Basic knowledge of size measurement and materials.

**Rationale:**

To study nanotechnology materials can effectively be made stronger, lighter, more durable, more reactive, more sieve-like, or better electrical conductors, among many other traits.

Nanotechnology provides a link between classical and quantum mechanics in a gray area called a macroscopic system. This macroscopic system is being used to manufacture nano-assemblies of nature such as agricultural products, nano-medicine, and nano-tools for treatment and diagnostic purposes in the medical industry.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	SEE		CCE		
			Theory		Practical	MSE	LWA/V	ALA	
4	0	0	4	100	0	30	0	70	200

*Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voice; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.*

4 Credits \* 25 Marks = 100 Marks (each credit carries 25 Marks) Theory

SEE 100 Marks will be converted in to 50 Marks

CCE 100 Marks will be converted in to 50 Marks

It is compulsory to pass in each individual component.



**Continuous Assessment:**

<b>Sr. No</b>	<b>Active Learning Activities</b>	<b>Marks</b>
1	<b>Synthesis and Growth of single crystal</b> Faculty will assign the substance name for the synthesis and students will grow the Nano material. Students will take photographs of as grown crystals and write a report on growth process in 150 to 200 words and upload it to GMIU web Portal.	10
2	<b>Poster Preparation</b> Based on the theme assigned by faculty, students will prepare a poster and upload it to GMIU web Portal.	10
3	<b>Evolution Characterization Techniques</b> Faculty will provide one characterization technique and a group of students will evolution and write about their techniques in 300 words and upload it to GMIU web Portal. (Max. 3 students in 1 group).	10
4	<b>Current Affairs on Nanotechnology</b> Students have to prepare a report on current Nano-Technology affairs in 150 words (as per format) and upload it to GMIU web Portal.	10
5	<b>Draw, Label and Describe</b> Faculty will assign a list of instruments and students will prepare a diagram, label and short description on any one instrument and upload it to GMIU web Portal.	10
6	<b>Write using your Active Brain</b> Faculty will provide a picture or video clip and students will observe, analyze and write about it and upload it to GMIU web Portal.	10
7	<b>Attendance</b>	10
<b>Total</b>		<b>70</b>



**Course Content:**

Unit No.	Course content	Hrs	% Weightage
1	<b>Chapter - 1: Introduction and preparation:</b> Introduction of Nanomaterials, Optical, magnetic and chemical properties of Nanomaterials, Preparation of Nanoparticles: Chemical Approaches: Chemical reduction: sonochemical synthesis, Sol-Gel Synthesis, Self-assembly, Physical Approaches, Aerosol, Laser vaporization and vapor deposition, sputtering.	11	25 %
2	<b>Chapter - 2: Nanostructure materials:</b> Quantum dots, wells & wires, Carbon Nano-tubes (CNTs), Single walled carbon nano-tubes (SENTS), Multiwalled carbon nano-tubes (MWCNTs), Graphene, Fullerenes, Metal Oxide Nanoparticles (NPs), Nano-rods, Nano-tubes and Nano-fibers, Semiconductor quantum dots Polymer NPs.	11	25 %
3	<b>Chapter-3: Characterization Techniques for Nanomaterials:</b> Particle size Analyzer (Laser scattering), Optical Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunnel Microscopy (STM).X-ray Diffraction (XRD), Auger Emission Spectroscopy, Electron Spectroscopy for Chemical analysis (ESCA)	12	25 %
4	<b>Chapter - 4: Application of Nanomaterials:</b> Application Solar energy conversion and catalysis, Polymer with a special architecture: Liquid crystalline systems, Application in displays and other devices, Advanced organic materials, data storage, Photonics, Chemical and biosensors, Nano-medicine and Nano-biotechnology.	11	25 %

**Suggested Specification table with Marks (Theory): 100**

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	35%	40%	25%	-	-	-

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.



**Course Outcome:**

After learning the course, the students should be able to:	
CO1	Synthesize the Nanoparticles.
CO2	Analyze nano-structured materials for any substance.
CO3	Apply different characterizations techniques for nano-materials
CO4	Implement deferent applications of Nanomaterials in organic materials, data storage, Photonics, Chemical, biosensors, Nano-medicine and Nano-biotechnology.

**Instructional Method:**

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

**Reference Books:**

- [1] Introduction to Nanotechnology by Risal Singh and Shipra Mital Gupta.
- [2] Elements of X-ray diffraction, B D Cullity- Addison-Wesley Publishing Company, Inc.
- [3] Introduction to Nanotechnology by Charles P. Poole, Jr., Frank J. Owens.
- [4] Nanostructure and Nanomaterials: Synthesis, Properties and Application by G. Cao, Imperial College Press, 2004
- [5] Science & Engineering – An Introduction by William D. Callister Jr.
- [6] Encyclopedia of Materials Characterization, C. Richard Brundle and Charles A. Evans, Jr
- [7] Willard, Merritt, Dean, Settle - Instrumental Methods of Analysis, 7th edition
- [8] Grain growth and control of microstructure and lecture in polycrystalline materials by V. Lu. Novikov & Vladimi Novikov

