Master of Science – Nano Science & Nano Technology

(M.Sc.)(Nano Science & Nano Technology) Semester –I

Course Code	PS01CNST51	Title of the Course	Fundamental Materials Science
Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	1. To provide fundamental knowledge of Nanoscience & Nanotechnology 2. To share basic information on materials science terminology

Course Content		
Unit	Description	Weightage* (%)
1.	Classes of Naostructured materials, Zero dimensional nanostructures, one dimensional and two dimensional nanostructures, basic techniques for preparation of nanomaterials.	25%
2.	Surface Energy, Chemical potential as a function of surface curvature, covalent and noncovalent interactions, Intramolecular and Intermolecular Potential energies and Forces, van-der Waals attraction potential, interaction between two particles, DLVO theory, steric stabilization, mixed steric and electric interactions.	25%
3.	Laws of thermodynamics, Thermodynamics functions, Heat capacity, Enthalpy, Internal Energy, Gibbs potential, Heat content, Entropy, Free energy, Reversible & ir-reversible process, Adiabatic process, carnot cycle, Refrigeration Engine.,Gibbs Helmholtz equations and its limitation, Nernst heat theorem, Consequences of third law. Thermodynamics of small systems.	25%
4.	Inadequacy of classical concepts of Black Body Radiation of Plank's quantum hypothesis, electromagnetic radiation. Wave particle duality, space quantization, limitations of the oldquantum theory matter waves, the uncertainly principle the formulation of quantum mechanics.The schrodinger equation in one and three dimension, Physical Interpretation and conditions on the wave function, expectation values, stationary states. A particle in a square well potential, in a box, towards potential step. Exactly soluble eigenvalue problems, the simple harmonic oscillator, angular momentum and parity, the rigid rotator, a particle in a central potential, the Hydrogen atom problem, the anisotropic and isotropic oscillators.Approximation methods perturbative theory for discrete levels, equations in various orders of perturbation theory, the non-degenerate first and second order case, stark effect and its applications, the variation methods for ground state	25%

	and excited state trial functions linear in variational parameters, the Hydrogen molecules.	

Teaching-Learning Methodology	Group discussion/ Panel/Presentation

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Understand the terminology and basic fundamental information of Materials Science & Nanosicence.
2.	This can be very helpful for their future understanding on subject. This subject can provide a strong base to learn upcoming topics in syllabus.

Suggested References:	
Sr. No.	References
1.	Glasstone, S. (1947). *Thermodynamics for chemists.* D. Van Nostrand Company, Incorporated. New York, USA.
2.	Sears, F., & Salinger, G. L. (1998). *Thermodynamics Kinetic Theory & Statistical.*
3.	Woodward, L. A. (1975). *Molecular statistics for students of chemistry*. Clarendon Press.
4.	Mathews, P. M., & Venkatesan, K. (1978). *A textbook of Quantum Mechanics*. Tata McGraw-Hill Education.
5.	Callister, W. D., & Rethwisch, D. G. (2018). *Materials science and engineering: an introduction* (Vol. 9). New York: Wiley.

6.	Wang, Y., Cao, G. (2011). *Nanostructures and Nanomaterials: Synthesis, Properties, and Applications.* World Scientific.

On-line resources to be used if available as reference material
On-line Resources
http://www.matweb.com/
https://www.nde-ed.org/EducationResources/CommunityCollege/Materials/Mechanical/Tensile.htm
http://www.istl.org/02-spring/internet.html
http://www.learncheme.com/screencasts/materials-science
https://nptel.ac.in/courses/112/108/112108148/

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