Shiv Nadar Institution of Eminence (Deemed to be University)

Material Science and Engineering (MED201)

PART A: COURSE IDENTIFIERS

1. School	**School of Engineering**
2. Department	**Department of Mechanical Engineering**
3. Course Code	**MED 201**
4. Course Title	**Material Science and Engineering**
5. Credits (L:T:P)	**3:0:1**
6. Contact Hours (L:T:P)*	**3:0:2**
7. Prerequisites	**None**
8. Major Core for**	**Computer Science Engineering (Ist year)**

Course Instructors:

Dr. Ranjit Kumar (**Instructor**)

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Dr. Meha Bhogra (**Instructor**)

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PART B: OBJECTIVES AND PRACTICE

Course Content

Chapter-1: Introduction

Material science and engineering, need to study materials science, relevance of materials science in computer engineering, classification of engineering materials, advanced materials: smart materials, semiconducting materials.

Chapter-2: Atomic structure and inter-atomic bonding

Fundamental concepts: electronic configurations, arrangement of electrons in atoms, periodic table, bonding forces and energies: primary and secondary bonds, equilibrium and kinetics, stability and metastability, basic thermodynamic functions, entropy, structure-property relationship.

Chapter-3:

a. Crystal Geometry and Structure Determination

Geometry of crystal, space lattice, unit cell, crystal structure, crystal systems, Bravais lattices, crystal directions and planes, structure determination by X-ray diffraction

b. Non-crystalline and amorphous structure

Non-crystalline and polycrystalline materials, disordered and amorphous materials.

Chapter-4: Structure of engineering materials

- **a. Metals:** Concept of closed packing, atomic density, linear and planar densities, polymorphism.
- **b. Ceramic materials:** radius radio rules, different crystal structures, packing density.
- **c. Polymers:** Concept of molecular weight, molecular shape, structure and configuration.
- **d. Composites:** Types of composite materials

Chapter-5: Crystal Imperfections

Defects in materials, point defects, dislocations, properties of dislocations, dislocation theory, surface imperfections.

Chapter-6: Mechanical properties of materials
Concept of stress and strain, elastic deformation, plastic deformation, strengthening, hardness, mechanical properties of metals, ceramics and polymers.

Chapter-7: Electrical properties of materials:
Ohm's law, electrical conductivity, energy band structure, electrical mobility, semiconductivity: intrinsic and extrinsic semiconductors, temperature dependence of carrier concentration, semiconducting devices, electrical properties of polymers.

Chapter-8: Magnetic properties of materials:
Diamagnetism, paramagnetism, ferromagnetism, anti-ferromagnetism, temperature-dependence of magnetic properties, hysteresis, magnetic materials: soft magnets and hard magnets, magnetic storage.

Chapter-9: Thermal properties of materials:
Heat capacity, thermal expansion, thermal conductivity, thermal stresses and thermo-electric materials.

Teaching and Learning Strategy

Teaching and Learning Strategy	Description of Work	Class Hours (Per Week)	Out-of-Class Hours (Per week)
Lectures based learning	In class discussion including quizzes	3 hours	6 hours
Lab based learning	Practicals	2 hours	4 hours

PART C: ASSSESSMENT

Assessment Strategy

Formative Assessment: Quizzes
Summary Assessment: Mid-term Exam, Final Exam

Assessment Scheme

Type of Assessment	Description	Percentage
Quizzes	Multiple-choice questions and numerical	20
Midterm examination	Short and long type subjective questions, derivations and numerical	25
Endterm examination	Short and long type subjective questions, derivations and numerical	30
Lab work	Viva voce/quiz along with practical assessment (experiment performed by individual)	10+15
	Total	**100%**

I. **Reference books**

1. William D. Callister, "Material Science and Engineering", Wiley
2. V. Raghavan, "Material Science and Engineering: A First Course", PHI

II. **Attendance criterion** – 75 % of lectures

Class participation necessary.