Note: **Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.**

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE-10)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
MATERIAL SCIENCE	4	3	0	1	Class 12th with Physics, Chemistry	---

Learning objectives

- To introduce the fundamentals of material science especially dielectric materials, semiconducting materials and nanomaterials
- To impart knowledge of different types of materials, their properties and applications

Learning outcomes

After studying this paper, students will be able to

- Explain the structure, function, properties of various materials
- Apply the knowledge of smart materials for desired applications

SYLLABUS OF DSE-10

THEORY COMPONENT-

UNIT 1: (15 Hours)

BASICS OF MATERIALS STRUCTURE

Amorphous and crystalline structure, unit cells and space lattices, X-ray diffraction of crystal structures, miller indices of planes and directions, packing geometry in metallic, covalent and ionic solids, single and polycrystalline materials, imperfections in crystalline solids magnetism, intrinsic and extrinsic semiconductors, dielectric properties, absorption and transmission of electromagnetic radiation.

UNIT 2: (15 Hours)

ADVANCED MATERIALS

Ferroelectric, piezoelectric, optoelectronic, semiconducting behaviour, lasers and optical fibres, photoconductivity and superconductivity, nanomaterials (synthesis, properties and applications), biomaterials, shape memory alloys, Ceramics: structure, properties, processing and applications of traditional and advanced ceramics.

UNIT 3: (15 Hours)

METALS AND ALLOYS

Solid solutions, solubility limit, intermediate phases, intermetallic compounds, iron-iron carbide phase diagram, heat treatment of steels, cold, hot working of metals, recovery, recrystallization and grain growth. Microstructure, properties and applications of ferrous, non-ferrous alloys and polymer alloy

PRACTICAL COMPONENT (30 Hours)

- To check the hardness of composite materials by rockwell hardness tester.
- To determine % composition of metals, fillers etc.
- Thermogravimetric analysis of different Polymers (Using TGA)
- Determination of degradation profile and filler content of a polymer (using TGA).
- Study of mechanical stress v/s strain behavior of a polymer (tensile and flexural)
- Determination of impact strength of a polymer by izod method.
- Determination of impact strength of a polymer by charpy method.
- To determine magnetic properties of materials.
- To determine mechanical properties (strength, modulus) of materials.
- Preparation of advanced polymer composite material for different applications (packaging and biomedical).
- To prepare safety glass and evaluate its properties.

ESSENTIAL/RECOMMENDED READINGS

- Shackelford J.F., (2010) Materials Science And Engineering Handbook, Third Edition CRC Press.
- Mittemeijer E.J., (2011) Fundamentals of Materials Science: The Microstructure–Property Relationship Using Metals as Model Systems, Springer.
- Sedha R.S., Khurmi R.S., (2004) Materials Science, S. Chand.

SUGGESTIVE READINGS

- Kakani S.L., Kakani A., (2006) Material Science, New Age International.
- Yao J., Zhou Z., Zhou H., (2019) Highway Engineering Composite Material and its Application, Springer.

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DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE-11)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
SMART MATERIALS	4	3	0	1	Class 12th with Physics, Chemistry	---

Learning objectives

- Overview of smart materials, Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electroactive Polymers, Shape Memory polymers.
- To learn the fundamentals of electro and magneto rheological fluids, thermally responsive polymers, modelling of smart materials, introduction to composite smart materials and smart hydrogels.

Learning outcomes

After studying this paper, students will be able to

- Explain polymer based smart materials
- Demonstrate applications of smart materials.

SYLLABUS OF DSE-11

THEORY COMPONENT-

UNIT 1: (15 Hours)

INTRODUCTION