MSN 602 SYNTHESIS OF MATERIALS

L	T	P	Credits		
4	-	-	04	Sessional Marks:	50
				Finals Marks:	100
				Duration of Exams:	3 Hours

OBJECTIVES:

1. To understand the various types and classes of materials which are useful for advanced societies.
2. To understand the sources and applications of the various materials of human need.
3. To understand the science and technologies involved in the synthesis of useful materials from precursors.
4. To understand the synthesis methodologies of technologically advanced materials such as catalysts, semiconductors and specialty alloys.
5. To understand the whole spectrum of synthesis of materials – from bulk synthesis for commercial applications, to micro synthesis for nanotechnology devices.

OUTCOME:

1. Describe and explain the properties, applications, and synthetic mechanisms of important classes of materials, including advanced alloys, semiconductors, biomaterials and polymers.
2. Explain the physical principles of key techniques for characterizing materials, including X-ray crystallography and applying these techniques.
3. Compare the strengths and weakness of the major materials classes;
4. Identify the principal concerns of common materials processing techniques; and examine advantages and disadvantages of alternative processing techniques when selecting materials.
5. Select candidate materials for various engineering design scenarios;
6. Rank competitive materials using handbook data;
7. Propose general syntheses for important classes of materials and provide mechanisms to explain their formation.
8. Understand the concepts of nucleation and controlled growth of particles.
9. Understand the role of physics, chemistry, engineering and technology in creating advanced materials such as nanostructured materials and biocompatible materials.
10. Identify examples of combining materials from different classes to fabricate composite materials, often with unique properties;

Books:

1. Treatise on Inorganic Chemistry, Vol. II: Subgroups of the periodic table and general topics,
2. Preparation of Metals - H. Remy, Elsevier, 1956.
3. Chemical Synthesis of Advanced Ceramic Materials –David Segal, Camb. Univ. Press.
4. Diffraction of X-rays by Chain Molecules - B. K. Vainshtein, , Elsevier, Amsterdam, 1966
5. Polymer Single Crystals - P. H. Geil, Interscience-Wiley, New York, 1963
6. Fundamentals of Polymer Science - P. Painter and M. Coleman, Technomic, 1997
7. Composite Materials: Engineering and Science - F. L. Matthews and R. D. Rawlings, Chapman & Hall 1994
8. Synthesis and technique in inorganic chemistry: a laboratory manual - Girolami, Gregory S. -Rauchfuss,
9. Thomas B. - Angelici, Robert J., 3rd ed. Sausalito, Calif. University Science Books, 1998.
10. Solid State Chemistry - Techniques - Cheetham, A K - Day, Peter, OUP, 1987.
11. Solid State Chemistry – Compounds - Cheetham, A K &Day, Peter, OUP, 1992.
12. Materials Syntheses – A Practical Guide, U. Schubert, N. Husing and R.M. Laine, Springer Verlag.

LECTUREWISE PROGRAMME: (from 08.01.18 to 27.04.18) No. of Lectures (ideal)

Introduction of the subject (08.01.18)

UNIT I: 14 (1+5+4+4)

Extraction of Metals – Fe, Al, Au and Cu; Techniques of extraction of metals from ores

Synthesis of Ceramics: Metal oxides/nitrides/ferrites, Glasses, Semiconductors,

Aluminosilicates

Synthesis of Polymers: Chain Reaction Polymerization, Coordination Polymerization, Step Reaction Polymerization; *Fabrication Techniques*: Foam Processing, Film-Forming Processes, Composites, Extrusion, Molding and Coatings.

UNIT II: General Synthesis Techniques:

Solid State Synthesis Methods; Melting and solidification; Microwave Synthesis; Sol-Gel Methods; Precursor Methods; Hydrothermal Methods; PVD; CVD (chemical vapor deposition); Chemical Vapour Transport; Lithography — 15 (3+1+1+2+1+1+2 +2+1+1)

UNIT III: High Strength Materials' Synthesis:- Diamond thin films, Carbon fibers, high-strength steels, Ni and Ti alloys.

Electronic Materials' Synthesis: Elemental, doped and compound semiconductors; MOSFET.

Catalysts in the Synthesis of Materials — 9 (4+3+2)

UNIT IV: Materials for Environmental Monitoring and Control; Synthesis of Biomaterials; Synthesis of Nanomaterials; Synthesis of Materials for Optical Applications; Synthesis of Single Crystals — 10 (1+2+4+1+2)

Home Assignments: 4 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject. A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%),C (46% - 54%), D (40% - 45), F (Less than 40 %) For F grade, a candidate shallbe required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Chamber consultation hour: Any available time, but preferably 12 noon - 1p.m.

Note:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit (1 & 2 from unit I, 3 & 4 from unit II, 5 &6 from unit III and 7 & 8 from unit IV). The students will be required to attempt only 5 questions selecting at least one question from each unit. All questions will carry equal marks.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

(Dr. Brijnandan S. Dehiya)