GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Mechanical Engineering (CAD/CAM)

Subject Name Material Science and Materials

Sr.No	Course content
1.	STRUCTURE – PROPERTY RELATIONSHIP : Atomic structure & Chemical bonding, Crystalline & Network structure, Grain structure, Grain deformation & Anisotropic properties, Properties of material, Physical, Chemical, Electrical, Thermal & Mechanical.
2.	THERMAL PROPERTIES OF MATERIALS : Specific Heat: Classical, Einstein, Debye theory, Anharmonic crystal imperfections, Electronic specific heat, Thermal Expansion, Hypothetical & Actual Energy Curves.Thermal Conductivity, Wridemann – Franz ratio.
3.	PERFORMANCE OF MATERIALS IN SERVICE :Performance based on - static properties, dynamic properties and temperature effect. methods of testing & interpretation of test results.
4	THEORY OF ELASTICITY AND PLASTICITY: Fundamentals- Methods - Yield surface.
5	ADVANCED MATERIALS:Super alloys, Ferro electric and piezoelectric materials, Advanced magnetic materials, Advanced engineering polymer materials, Advanced ceramic and composite materials, photo conducting and photovoltaic materials, electro-optic materials, Lasers, smart materials. Bio-materials – Determining mechanical properties and their applications. Recent trends in Bio-Material Characterization.
6	PROCESSING OF MATERIALS:Conventional processing techniques for advanced materials, special processing techniques, use of computers in metal processing.
7	CHARACTERIZATION AND EVALUATION TECHNIQUES:Destructive and Non-destructive evaluation techniques, Electron and X-ray techniques, Distortion and Residual stress measurement.
8	PERFORMANCE OF MATERIALS IN SERVICE:Service performance, corrosion and its control, Delayed fracture, Performance of materials at High & low temperatures, Radiation damage and recovery

REFERENCE BOOKS:

1. Material Science for engineers by James F Shackelford & Madanapalli K. Muralidharan, Pearson Education.
2. Elements of Material Science – Sixth edition by Laurence H. Van Vlack, Pearson Education.
3. Engineering Design- A Material and Processing Approach / George E. Deiter, McGraw Hill Intl., 2nd Edition, 2000.
4. Theory of Elasticity and Plasticity by Timoshenko.
5. Engineering Materials & Their Applications. – R. A. Flinn & P. K. Trojan.
6. Materials & Process In Manufacturing. – E. Paul Degarmo & J. I. Black.
7. Material – Selection & Design. – ASM Handbook Vol.-20.
8. Materials – Principles & Practice. – Charles Newey & Graham Weaver.
9. Material Science & Engineering. – Callister W. D.