

**B. Tech (Metallurgical & Materials) Syllabus from Admission Batch 2018-19**  
**5<sup>th</sup> Semester**

<b>5<sup>th</sup> Semester</b>	<b>RMM5D004</b>	<b>Selection of Engineering Materials</b>	<b>L-T-P 3-0-0</b>	<b>3 Credits</b>
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**Module I:**

**(9 Hours)**

Classification of Engineering Materials. Engineering properties of materials. Selection of Materials. Electron theory of solids : Free electron theory of metals. Electrical conductivity; Thermal conductivity,  
Quantum theory of free electrons. Band theory of solids, Conductivity of metals  
Conductors, Insulators, Semiconductors, Intrinsic and extrinsic semiconductors, Band theory of semi conductors Hall effect.

Super Conductors – Zero resistivity, Critical magnetic field and critical current density. Type I and II super conductors. Applications of Supercoductors.

**Module II:**

**(9 Hours)**

Dielectric Materials : Microscopic Displacement of atoms and molecules in an external dc electric field,

Polarization and dielectric constant, Dielectric \_nitially\_lity. Temperature dependence, Dielectric Breakdown.

Ferro electric material Piezoelectrics, Pyroelectrics, Dielectric Materials as electrical isulators.

Magnetic Properties of Materials :Dia, Para and Ferro magnetic materials. Theory of magnetism, Ferro

magnetic materials or Ferrites, Comparison of magnetic behaviour and magnetic parameters of Dia, Para and

Ferro magnetic materials.

**Module III:**

**(6 Hours)**

Optical Properties of Materials : Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of

optical properties. Lasers, Optical fibres – Principle, structure, application of optical fibre.

Plastics – Types : Thermosetting and thermoplastics. Transfer moulding, injection moulding, extension

moulding, Blow moulding, Welding of plastics; Rubber types, application.

**Module IV:**

**(8 Hours)**

The urge for advancement in materials development and processing, Special and high temperature alloys: Ti alloys: physical and mechanical properties, thermo-mechanical treatment of Ti-alloys, Ti shape memory alloys, Fe based super alloys, Ni based alloys, Co based alloys, engineering applications at elevated temperatures.

Metallic Foams: Material Definition and Processing, Characterization of cellular metals, Material properties and applications

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**Module V:**

**(8 Hours)**

Bio-Materials: Various types of biomaterials, Biopolymer, Bioceramics, Nanostructured bio-materials, Classes of materials used in medicine, Application of materials in medicine and dentistry, Various materials and coatings for implants.

Carbon and alloy steels: high strength low alloy structural steels, medium-high carbon ferrite-pearlite steels, common alloy steels, Tool steels: classification, composition, structure, properties, heat treatment and uses of different types of tool steels, Special steels: heat resisting steels, Hadfield manganese steels, TRIP steels, maraging steels, dual phase steels.

**Books:**

- [1] Rajendra V., Marikani A., Materials Science, TMH
- [2] Materials Science and Engineering - An Introduction by William D. Callister, Jr., John Wiley & Sons.
- [3] Engineering Materials – properties and selection by K.G. Budinski and M.K. Budinski, PHI.
- [4] Structure-Property Relations in Nonferrous Metals by Alan Russell, Kok Loong Lee, Wiley.

**Digital Learning Resources:**

Course Name: Material selection and design

Course link :<https://nptel.ac.in/courses/112/104/112104122/>

Course Instructor: Coordinated by IIT Kanpur

Course Name: Materials Selection in engineering design

Course link :<https://youtu.be/my63D9zG7bc>

Course Instructor: Prof Bishakh Bhattacharya, IIT Kanpur

Course Name: Engineering Materials

Course link :<https://youtu.be/m911tVXyFp8>

Course Instructor: Prof B. Maiti, IIT Kanpur

Course Name: Advanced Materials and processes (Superalloys, SMA)

Course link :<https://youtu.be/m911tVXyFp8>

Course Instructor: Prof B.S.Murty, IIT KGP