

## PMM334: POWDER METALLURGY

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>3.5</b>

**Course Objective(s):** To introduce the students with important materials processing technique. To familiarize the students with the principles of powder metallurgical technique. To introduce the students with few case studies where powder metallurgical techniques are successfully used to produce super-hard and intricate materials parts.

**Fabrication Techniques:** Introduction, Different methods of powder production viz Milling, atomization, Reduction, Electrolysis, Carbonyl process.

**Characterization:** Chemical composition, Structure, Morphology, Shape, Size, Distribution, Surface area, Powder flow, Apparent density, Tap density, Compressibility, Porosity.

**Consolidation:** Powder mixing and blending, Compaction techniques, Uniaxial, Isostatic compaction, Extrusion, Forging, Rolling, Injection molding, Tape forming, Slip casting, Sol-gel casting, Types of processes, Tooling and Die design.

**Sintering:** Solid state sintering, Liquid phase sintering, Reaction sintering, Hot pressing, Hot isostatic pressing, Self-propagating combustion sintering, Sintering atmosphere.

**Applications:** Application and uses of P/M products viz Filters, Contact materials, Bearing, Structural parts.

### **Course Learning Outcomes (CLO):**

1. Students would learn a host of processing techniques which have industrial utility;
2. Students could employ some of these techniques in their own research.

### **Recommended Books:**

1. *Randall M. German, Powder Metallurgy Science, Metal Powder Industries Federation, Princeton, New Jersey (1984).*
2. *ASM Hand book, Vol. 7: Powder Metallurgy, ASM International, (2010).*
3. *W.D. Kingery, H.K. Bowen and D.R. Uhlmann: Introduction to Ceramics, John Wiley & Sons, New York, (2009).*
4. *G. S. Upadhyaya: Powder Metallurgy Technology, Cambridge International Science Publishing, (2002)*