Textbook: Randall M. German, **Powder Metallurgy & Particulate Materials Processing**, Metal Powder Industries Federation, 2005.

Date	Class	Lecture Subject	Homework
8/23	1	Introduction	
8/28	2	Powders and particles	2: 1, 3, 4
8/30	3	Characterization of particles and agglomerates	2: 9, 17, 18
9/04	4	Mechanical fabrication of powders	3: 13, 21
9/06	5	Chemical synthesis of powders	3: 6, 10
9/11	6	Atomization techniques	3: 15, 16
9/13	7	Microstructure of powders	4: 2, 3
9/18	9	Solidification rate & microstructure	4: 13, 15
9/20	10	**TEST # 1**	
9/25	11	Particle handling and modification	5: 13, 14
9/27	12	Powder additives and mixing	5: 16, 21
10/02	13	Principles of low-pressure consolidation of powders	6: 1, 4
10/04	14	Injection molding technology	6: 5, 6
10/09	15	Powder extrusion	6: 7, 8
10/11	16	Principles of high-pressure compaction of powders	7: 1, 3
10/16	17	Die compaction technology	7: 8, 10
10/18	18	Design and simulation of compaction processes	7: 16, 19
10/23	19	Principles of sintering	8: 2, 3
10/25	20	**Mid-Semester Study Break**	
10/30	21	**TEST # 2**	
11/01	22	Kinetics of solid-state sintering	8: 4, 7
11/06	23	Structure and evaluation of sintered products	8: 13, 24
11/08	24	Liquid phase sintering and grain structure	8: 11, 18
11/13	25	Sintering practice and technology	9: 1, 4
11/15	26	Design and simulation of sintering operations	9: 6, 7
11/20	27	Principles of densification technologies	10: 4, 5
11/22	28	**Break**	
11/27	29	**TEST # 3**	
11/29	30	Hot pressing technologies	10: 6, 11
12/4	31	Hot powder forging and extrusion	10: 9, 10
12/6	32	Review	

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Class Day & Hour: TR 11:00am – 12:15pm
Office Hours: W 2:00 - 4:00pm.
Final Exam Date: December 14, 2018
Final Exam Time: 8:00 -10:30am

Course Policy and Procedure

Course Overview:	This course aims at providing metallurgical engineering students with in-depth knowledge of powder metallurgy technology which is one of principal technologies for manufacturing near net-shape products. This course covers all processing steps involved in transforming powders into consolidated products, starting from powder fabrication to sintering of compacted powders with emphasis on the scientific principles associated with design and operation of these processes and on the structure and physical properties of the final product. The applications and specific engineering details are used as illustration. The ultimate goal of this course is to make students be able from the materials learned to select and design the optimal processing route for any given product properties
Course Objectives:	To gain insight into scientific principles underplaying design and operation of PM processes To give some insight into the properties and uses of powders and PM products. To learn the technology To be able to select and design the optimal processing route for any given product properties.
Student Learning Outcomes:	Powder metallurgy (PM) is the science and processing of intricate shaped objects from powders. Students will learn all the manufacturing steps to produce the final product including (1) Powder production; (2) Powder characterization, properties, and microstructure control; (3) Particle handling, modification and mixing; (4) Shaping and compaction; (5) Sintering and consolidation; (6) Finishing operation; (7) Applications, advantages, and limitations. The students will also learn all the aspects of this manufacturing process with emphasis on structure-processing-properties relationships.
Grading:	The final grade will be determined as follows: Homework problems 15% Design project 25% Tests 30% Final Examination 30%
Homework and projects:	Homework consists of quantitative problems, all from the textbook. These will be collected when due, checked off by the instructor, and returned. In addition to regular homework problems, you are required to develop a design project for a P/M part, from powder production to final shipment.
Exams:	Three exams will be given during the semester, and they are listed in the syllabus. Make-up exams are given only when approval is obtained in advance.
Final Exam:	If the final exam is missed, the student must (1) get an excuse from the Office of Student Services, (2) pay a fee at the Bursar's Office (and get a permit to take the exam), and (3) take the make-up examination at the beginning of the next term.
Attendance:	Although attendance has no effect on the final grade, students are expected to attend all classes in order to maintain an adequate level of performance on the homework, assignments and exams.
Collaboration:	The discussion and exchange of ideas is an important part of the

	learning process, and I encourage such activity in a community of scholars. However, you should be sure that any work you submit for grading is your own.
Professionalism:	Students are reminded that they are preparing for a profession that has a Canon of Ethics for professional behavior. This canon will be applied toward all class activities and assignments. If you are not familiar with the Canon of Ethics for Engineers, it is available in the Engineering Library.
Make-up Classes:	In the event a scheduled class is canceled due to inclement weather, etc., the homework assignment will be doubled up at the next scheduled class meeting.

Note: These policies will be strictly enforced on all students <u>except those with disabilities who notified the university</u>. To request disability accommodations, please contact the Office of Disability Services (348-4285). After initial arrangements are made with that office, please come and see me to finalize these arrangements for this class.