930. *Seminar*

Fall, Winter, Spring. 1 credit. May re-enroll for a maximum of 3 credits in master's program; 6 credits in doctoral program. Open to graduate students of all colleges and departments.

Recent developments in space orbit theory, theory of space propulsion, magnetohydrodynamics, re-entry phenomena, ionosphere, space radiation phenomena, design of space vehicles, and developments in the field pertinent to space technology such as external environmental conditions, internal environmental conditions, effects upon space vehicle construction, etc.

941. *Advanced Gas Dynamics II*

Fall of odd-numbered years. 3(3-0) 841.

Transonic flows, blunt bodies in supersonic flows, three-dimensional supersonic flows, hodograph methods, characteristics, unsteady phenomena, physical gas dynamics.

942. *Viscous Fluids*

Fall of even-numbered years. 3(3-0) MMM 810 or CHE 841.

Exact solutions of Navier-Stokes equations, i.e., Oscillatory Motion, Laminar Jet, Converging Channel, etc.; Hydrodynamic Stability including free convection, surface tension, gravitational and free-surface instabilities, and Tollmien-Schlichting waves.

952. *Slip and Free (Newtonian) Molecular Flows*

Spring. 3(3-0) 412, 432.

Distribution function; Boltzmann equation; solutions of Enskog-Burnett, Grad; slip flow; drag coefficient; heat transfer. Free molecule flow; elastic and inelastic reflections; flow around bodies; resistance coefficient; heat; oblation; meteors.

953. *Plasma Dynamics (Magneto-Gas Dynamics)*

Winter. 3(3-0) 432; PHY 467.

Fundamental equations of hydrodynamics; Maxwell equations; continuum; channel flow; boundary layer; shocks; Alfven wave propagation; one and two fluid theories; discrete particle approach; plasma oscillations; flow around bodies and in nozzles; space propulsion systems.

954. *Ion Flow Dynamics*

Spring. 3(3-0) 953.

Continuation of 953 as applied to the ion flow; extension of the neutral flow turbulence into electromagnetic turbulence, and method of characteristics applied to the ion flow dynamics.

999. *Research*

(EGR 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

MEDICAL TECHNOLOGY M T

College of Human Medicine

College of Veterinary Medicine

201. *Medical Technology*

Fall. 1(1-0) Approval of school.

Relationship of medical technology to medicine and research, and the necessary interaction with other paramedical sciences.

401. *Seminar in Medical Technology*

Fall. 1 credit. Seniors.

Acquaints students with the operation and administration of a hospital, the philosophy and understanding of the entire profession of medical technology.

MEDICINE MED

College of Human Medicine

590. *Special Problems in Medicine*

Fall, Winter, Spring. Summer. 1 to 6 credits. May re-enroll for a maximum of 12 credits. Human Medicine students.

Each student will work under direction of a staff member on an experimental, theoretical or applied problem.

METALLURGY, MECHANICS AND MATERIALS SCIENCE MMM

College of Engineering

205. *Mechanics I*

Fall, Winter, Spring. 4(4-0) MTH 214 or concurrently.

Vector description of forces, moments, and motion. Statics. Dynamics of particles and particle systems. Energy and momentum principles. Stability of equilibrium.

206. *Mechanics II*

Fall, Winter, Spring. 4(4-0) 205; MTH 215 or concurrently.

Dynamics of rigid bodies in general motion, plane motion, rotation, statics, variational methods.

211. *Mechanics of Deformable Solids*

Fall, Winter, Spring, Summer. 4(4-0) 205 or statics; MTH 215.

Deformable solids, stress and strain, principal axes, material behavior (elastic, plastic, viscoelastic, temperature dependent). Boundary value problems, torsion, beams. Instability, columns.

215. *Materials Testing Laboratory*

Fall, Winter, Spring, Summer. 1(0-3)

Physical properties of engineering materials, resistance to primary types of static loading.

230. *Introduction to Materials Science*

Fall. 4(4-0) Sophomores.

A qualitative survey of the atomic and molecular structure of materials and their related mechanical, thermal, electrical, and magnetic properties.

304. *Dynamics*

Fall. 4(5-0) Statics; MTH 215 or concurrently.

Dynamics of particles and rigid bodies for those students who have had statics.

320. *Analytical Mechanics I*

Fall. 3(3-0) MTH 215; PHY 289.

Measures of point motion, indicial notation, vector space and time transformations. Newton's, Lagrange's and Hamilton's equations. Motions of point objects; limiting wave forms.

321. *Analytical Mechanics II*

Winter. 3(3-0) 320.

Schrodinger's equation. Particle motions in various potentials; hydrogen-like atoms and molecules. Continuum models of particle systems; tensor properties, rigid and elastic solids, transfer of heat and electricity, flow relations.

322. *Analytical Mechanics III*

Spring. 3(3-0) 321.

Quantum and statistical models of particle systems; the Maxwell-Boltzmann, Einstein-Bose and Fermi-Dirac distributions; analysis of ideal atomic, electron and photon gases; properties of dense gases and liquids; thermal, elastic and electrical properties of crystals.

340. *Materials Chemistry I*

(440.) Fall. 4(4-0) CEM 153.

MMM 340, 341 and 342 present an integrated theory of chemical properties and phase transformations in metals and other engineering materials. Classical thermodynamics and thermochemistry of solids and solid solutions.

341. *Materials Chemistry II*

(441.) Winter. 4(4-0) 340.

Homogeneous and heterogeneous equilibria in solids; diffusion and solid-state reactions; nucleation phenomena. Metallurgy and electrochemistry. Theory of the periodic relations among the properties of the elements.

342. *Materials Chemistry III*

(442.) Spring. 4(4-0) 341.

Continuation of 341. The influence of atomic properties in the formation of alloys and solid compounds. Cohesive forces and bonding in solids. Introduction to the statistical theory of the properties of engineering materials.

360. *General Metallurgy*

Fall. 4(4-0) CEM 153 or approval of department.

Properties of metals, states of heterogeneous equilibrium and non-equilibrium, deformation processes.

361. *Physical Metallurgy I*

Winter. 4(4-0) 360.

Application of fundamental metallurgical theory to nonferrous metals and alloys.

362. *Physical Metallurgy II*

Spring. 4(4-0) 360.

Carbon and alloy steels: composition, influence of heat treatments, etc.

370. *Metals and Alloys I*

Winter. 4(3-3)

Principles of physical metallurgy applied to engineering metals and alloys.

371. *Metals and Alloys II*

Spring. 3(3-0) 370.

Continuation of 370.

372. *Metals and Alloys III*

Fall. 3(3-0) 371.

Continuation of 371.

380. *Metallurgy Laboratory I*

Fall. 1(0-3) 360 or concurrently

First of an integrated sequence of laboratory courses designed to illustrate the parallel theory courses.

381. *Metallurgy Laboratory II*

Winter. 1(0-3) 380; 361 concurrently.

Continuation of 380.

382. *Metallurgy Laboratory III*

Spring. 1(0-3) 381; 362 concurrently.

Continuation of 381.

400. *Special Problems*

Fall, Winter, Spring, Summer. 1 to 3 credits. May re-enroll for a maximum of 9 credits. Approval of department.

Individualized readings and research for students of high intellectual promise.