

## **Syllabus for the written preliminary examination in the concentration of Applied Physics.**

The exam will be open book and notes. Students are also allowed to use a computer, calculator, any references or written materials as they see fit. Students may also find software referenced at [www.aoe.vt.edu/research/onlinesoftware.html](http://www.aoe.vt.edu/research/onlinesoftware.html) useful in solving some prelim problems. Students' solutions must be strictly their own. No communication of any type, implicit or explicit, is allowed during the exam. The honor code will be strictly enforced.

The prelim exam will consist of a pool of questions covering the following 5 topic areas. Students are required to solve 4 questions out of this pool, and no more than 1 question can be chosen from each topic area. Questions will require the student to effectively apply their knowledge from across the area of concentration to familiar and unfamiliar situations. Questions will draw on material contained within the recommended texts/resources listed below. Courses related to these topics are also listed to facilitate the development of students' study plan. Questions may address a single topic, or integrate material from these different texts and courses under the same topic area.

### **Topic area 1: Numerical Methods**

Recommended text: 1) Burden, Richard and Faires, Douglas, "Numerical Analysis," 10th Edition

2) Chapra, Steven C. and Canale, Raymond P, "Numerical Methods for Engineers"

Related course: AOE 4404 (Numerical Methods)

### **Topic area 2: Plasmas physics or diagnostics**

Recommended text: 1) F.F. Chen, "Introduction to Plasma Physics and Controlled Fusion", Springer, 2006

2) Laser Diagnostics for Combustion Temperature and Species, by Alan C. Eckbreth, Taylor & Francis

Related courses: 1) AOE/ECE 5174 Plasmas Physics)

2) AOE5464 (Combustion Chemistry and Diagnostics)

### **Topic area 3: Aerodynamics, propulsion, or thermochemical non-equilibrium**

Recommended text 1) Karamcheti K, Principles of Ideal Fluid Aerodynamics, Kreiger, Reprint Edition, 1980.

2) Hill, P.G., and Peterson, C.R., 1992, Mechanics and Thermodynamics of Propulsion, 2nd Edition, Addison-Wesley.

3) Vincenti, W. G., and Kruger C.H., Introduction to Physical Gas Dynamics,

Related courses: 1) AOE5135 (Vehicle Propulsion)

2) AOE 5104 (Advanced Aero/Hydrodynamics)

3) AOE5984 (Thermochemical Non-equilibrium)

### **Topic area 4: Molecular or plasma dynamics**

Recommend text: 1) C. K. Birdsall and A.B. Langdon, "Plasma Physics via Computer Simulation", CRC Press, 2004.

2) S. Jardin, "Computational Methods in Plasma Physics", CRC Press, 2010.

3) Chemically Reacting Flow: Theory and Practice, by Robert J. Kee, et al., John Wiley & Sons.

Related courses: 1) AOE/ECE 6174 (Computational Plasma Dynamics)

2) AOE5464 (Combustion Chemistry and Diagnostics)

### **Topic area 5: Electromagnetic waves or electronics**

Recommended text 1) Jian-Ming Jin, "Theory and Computation of Electromagnet Fields", Wiley, 2010

2) Customized notes, publisher: Pearson. Contents include analog and digital circuit analysis techniques, electronic devices, communication theory and protocols, electromagnetic waves, practical antenna systems, noise mitigation in electrical systems, and environmental testing practices.

Related courses: 1) ECE 5105 (Electromagnetics)

2) AOE4984(Aerospace Electronics)