

Dr. Rama Balasubramanian (a.k.a) Dr. Bala

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Office Hours: MWF 11am-12 noon; Th 1-2 pm; Additional Hours: By Appointment

Course Overview: This course is a calculus based, rigorous introduction to modern physics. The students will be able to understand the fundamentals of scientific ideas and principles of physics, through lectures, homework, quizzes, class discussions and exams. The students will also engage in discussions and apply the underlying concepts to solve problems and understand the way things work. The students will also develop a scientific approach to solving physics problems using calculus and through a thorough grasp of the fundamental physics principles.

Learning Outcomes: Upon completion of this course, successful students will be able to

- Understand the wave-particle duality of matter and uncertainty principle
- Make connections to wave phenomena and fundamental nature of matter
- Apply mathematical approach in understanding the behavior of a quantum particle in different potentials
- Describe atomic structure and in atomic processes based on fundamental quantum rules
- Describe nuclear structure and discuss applications of nuclear physics
- Understand and apply the principles of radioactivity in solving problems related to nuclear decay schemes
- Study the standard model and conservation rules of particle physics

Prerequisites: Phys 202, Math 121

Course Materials:

- Required Book: Modern Physics For Scientists and Engineers : 2nd Edition, Taylor, Zafiratos and Dubson University Science Books, (2015)
- Recommended Book : Modern Physics: 3rd Edition, Raymond A. Serway, Clement J. Moses and Curt A. Moyer., Thomson/Brookscole (2005)
- Principles of Physics, 4th Edition with Modern Physics, Raymond A. Serway and John W. Jewett, Jr. Thomson/Brookscole (2006)

Grading: Grades for this course will be based on homework assignments, tests, quizzes, in-class assignments and student participation.

Homework	10%
Exam 1	10%
Exam 2	10%
Exam 3	10%
Quizzes	5%
MCSP Lecture Series	2%
In-class work, participation	8%
Final Exam	25%
Lab	20%

Points	Grade	Points	Grade
<60	F	76-79	C+
60-62	D-	80-82	B-
63-65	D	83-85	B
66-69	D+	86-89	B+
70-72	C-	90-94	A-
73-75	C	≥95	A

Expectation: Students are expected to put in a minimum of 12 hours/ week work outside the class in order to successfully complete this course.

Academic Integrity: Policies of Academic integrity are enforced in all aspects of this course. It is the responsibility of the student to strictly adhere to the policies of Academic Integrity of Roanoke College.

Homework: There will be at least one homework set each week, consisting of problems from the lectures given during the week. The homework sets are due at the beginning of class on the date announced. Late homework will not be accepted.

Quizzes: These will be about 10 minutes long and will be held during the lecture time. The quiz date will be announced during one lecture period prior to the quiz date. They will consist of 5-10 questions from the homework and lecture material. There will be no make-up quizzes – if you are absent, you get zero.

In-Class Problems and Participation: You will also be required to complete problems assigned in class. Participation in class discussions is also an important aspect of learning the material.

Homework: There will be one homework set each week, consisting of problems from the lectures given during the week. The homework sets are due the following week.

Quizzes: These will be about 10 minutes long and will be held during the lecture time. The quiz date will be announced during one lecture period prior to the quiz date. They will consist of 5-10 questions from the homework and lecture material. There will be no make-up quizzes – if you are absent, you get zero.

In-Class Problems and Participation: You will also be required to complete problems assigned in class. Participation in class discussions is also an important aspect of learning the material.

MCSP Colloquium Series: You are required to attend at least 2 of the several talks as a part of the MCSP colloquia this semester. You have to write up a paper on your reflections of the talk to get full credit (2 points). The reflection papers are due within one week of the talk.

Midterm Tests: There will be three tests during the semester. These will be part in class and part take home. Each test will cover the material listed on the syllabus or as informed by me in class, prior to the tests.

Final Exam: Yes, there will be a final exam at the end, and it is cumulative!

Labs: Labs are worth 20% of the grade and will be instructed by Dr. Fleenor. Students cannot pass this course without successfully completing all the requirements of Phys 203L

Attendance: Students are required to attend every class. Your attendance will be recorded each lecture period. If you show up 10 minutes late, you will be marked absent. Any student who has four consecutive absences will be dropped from the course. A warning e-mail/letter will be sent when the third consecutive absence occurs. Also any student who misses a total of five classes will be dropped from the class. This includes both excused and unexcused absences. A warning letter/email will be sent when the fourth absence occurs. Any unexpected absence due to health reasons/emergency situation/participation in a conference or sporting events representing the College should be supported by proper documentation such as doctor's note, court order, and schedule of conference/sports events. You will need to inform me prior to the absence or within 48 hours of such an absence to be considered as excused. It is best to inform me about your absence in person. Emails and phone voice messages are not very reliable. It is your responsibility to make up for the work that you missed. I will not extend the deadline for turning in homework or other work assigned in the class unless you have my prior approval.

Class Disruption: All students are entitled to a professional learning environment. Students should not act in a manner which will distract and disrupt the class learning experience. Such practices will not be tolerated. Cell-phones, pagers, beepers or any other electronic communication/entertainment devices must be turned off at all times during the lecture period.

Academic Integrity: Policies of Academic Integrity of Roanoke College are enforced in all aspects of this course. It is the responsibility of the student to strictly adhere to the policies of Academic Integrity of Roanoke College.

Philosophy: My teaching philosophy is not to make you memorize equations but rather help you understand the basics Physics. I am willing to work with you, if you need extra help. Please talk to me if you have any problems understanding the material. ASK QUESTIONS; GET YOUR DOUBTS CLEARED WITHOUT

PROCRASTINATION. Feel free to stop by my office. I believe that questions and clarifications are best addressed in person rather than via emails and phone. I would urge you to take full advantage of my office hours to get your questions answered.

Week	Date	Chapter	Topic
1	18-Jan		Introduction
	20-Jan	Ch 1	Relativity, Michelson-Morley Experiment
	22-Jan		Time Dilation, Length Contraction
2	25-Jan		Lorentz transformation
	27-Jan		Applications
	29-Jan	Ch 2	Relativistic Mass
3	1-Feb		Relativistic Momentum, Energy
	3-Feb		Mass Energy Equivalence
	5-Feb		Applications
4	8-Feb	Ch 3	Atoms, Molecules, Particles
	10-Feb		Avogadro number, Discovery of Electron
	12-Feb		Applications
5	15-Feb	Ch 4	Blackbody Radiation
	17-Feb		Compton Effect
	19-Feb	Exam 1 (Ch 1, 2 3)	
6	22-Feb		Wave Particle Duality
	24-Feb	Ch 5	Atomic Spectra
	26-Feb		Bohr Model
7	29-Feb	Ch 6	DeBroglie Hypothesis
	2-Mar		Wave Function
	4-Mar		Heisenberg's Uncertainty Relation
8	7-Mar	Spring Break	
	9-Mar		
	11-Mar		
9	14-Mar	Ch 7	Standing waves
	16-Mar		Particle in a Box
	18-Mar		TISE
10	21-Mar	Ch 7	Harmonic Oscillator
	23-Mar		Applications
	25-Mar	Good Friday	
11	28-Mar	Ch 9	Magnetic Spins
	30-Mar		Magnetic Moments
	1-Apr	Exam 2 (Ch 4, 5,6, 7)	
12	4-Apr	Ch 10	Pauli's Exclusion Principle
	6-Apr		Periodic Table
	8-Apr		Applications
13	11-Apr	Ch 16, 17	Nucleus
	13-Apr		Shell Model
	15-Apr		Radioactivity and Nuclear Decay
14	18-Apr		Nuclear Fission and Fusion
	20-Apr	Ch 18	Particle Physics
	22-Apr	Exam 3 (9, 10, 16, 17)	
15	25-Apr		Review
16	2-May		Final Exam (2-5 pm)