Phys 203 Modern Physics Spring 2019

Dr. Rama Balasubramanian (a.k.a) Dr. Bala
Room No: 243, Trexler/Massengill
Phone: 540-375-2057; E-mail: bala@roanoke.edu
Office Hours: MW: 2.20-3.20pm; TTh: 1.10-2.10 pm;
Online Office Hours: Wednesday 8.30-9.00pm
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 principles of general and special theory of relativity
- Make connections to wave phenomena, fundamental nature of matter and principles of Bohr model
- Understand the wave-particle duality of matter and uncertainty principle
- 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
- Understand implications of standard model and beyond on fundamental structure of matter and universe.

Prerequisites: Phys 202, Math 121

Course Materials:

- Required Book: Modern Physics For Scientists and Engineers : 4th Edition, Stephen Thornton and Andrew Rex, Cengage Publishers (2012) **ISBN: 9781133103721; ISBN10: 1133103723**
- Recommended Reference: Principles of Physics for Scientists and Engineers, Any edition, Raymond A. Serway and John W. Jewett, Jr. Thomson/Brookscole

Grading: Grades for this course will be based on homework assignments, weekly and monthly assessments, in-class work and student participation as well as laboratory work.

Homework	10%
Monthly Checkpoint – CP 1	10%
Monthly Checkpoint - CP 2	10%
Monthly Checkpoint - CP 3	10%
Weekly checkpoints (WCP)	10%
In-class work, participation	10%
Final Exam	20%
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 of work 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: This is the most important aspect for doing well in the course. Your overall homework grade is worth as much as one of your midterm exam grades**. It will help you keep up with the material. Students completing homework regularly tend to do well in exams**. So please give homework the due attention it deserves and turn it on time.

You will have homework problems each lecture day. (MWF). The homework sets are due at the beginning of next class meeting. For example, problems assigned on Monday will be due on Wednesday. Late homework will not be accepted. Homework problems will be assigned at the end of the lecture and will be mostly based on the material covered that day. Occasionally I will assign problems from earlier lectures. One low homework grade will be dropped at the end.

Weekly Checkpoints (WCP): These weekly checkpoints are used to assess your learning and understanding of the class and reading materials. It is a fancy word for quiz. I consider these to be way for you to assess how well you have understood the physics ideas and problems discussed during the week. These will be about 10 minutes long and will be held in class. You can expect a WCP every Friday. If this were to change, the new WCP date will be announced during one lecture period prior. They will consist of questions from the homework, textbook reading and lecture material. There will be no make-up WCP – if you are absent, you get zero. One low WCP grade will be dropped at the end.

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.

Checkpoints (CP): There will be three assessment of your learning called Checkpoints during the semester. This is another way to interpret the much-hated word "Midterm Exam". Since the word exam can set off some panic buttons, I would like you to view these CPs as a way for you to assess where you are in the learning process. If you do well on your homework, WCPs and inclass work, you will do well in these checkpoint assessments. The key to success is consistency and regularity in keeping with your daily learning. These CPs are scheduled roughly once a month and will be held in class on Feb 15, Mar 29th and Apr 17th respectively. Each CP will cover the material listed on the syllabus or as informed by me in class.

Final Exam: Yes, there will be a final exam at the end, and it is cumulative! It is scheduled on Mon , Apr 29th from 2-5pm.

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 form of texting, browsing social media or emails or text messages will result in an absence on your record. Any student who has four absences will be dropped from the course with a grade of DF. A warning e-mail/letter will be sent when the third absence occurs. 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 whenever possible. Only excused absences are eligible for makeup work. 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 automatically extend the deadline for turning in homework 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, or any other electronic communication/entertainment devices must be turned off or set in vibrate mode at all times during the lecture period. If you choose to leave the ringer on, cell phones must be put away in your backpack or in a "happy box" in the class room, where all your cell phones can take a break from their human companions. If you use a laptop for taking notes, it must be set in airplane mode.

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.

Special Evening Office Hours via ZOOM: I will have online evening office hours on Wednesdays from 8.30-9.00pm. You can attend these special learning hours via a virtual learning program called Zoom. I will post a link to Zoom on Inquire and instructions on how to join. Zoom tool is also mobile.

Class Schedule:

Week	Date	Chapter	Topic
1	14-Jan		Introduction
	16-Jan	Ch 1	Historical Beginnings of Modern Physics
	18-Jan		Galilean and Lorentz transformations
2	21-Jan	Ch 1	Michelson-Morley Experiment
	23-Jan		Time Dilation, Length Contraction
	25-Jan		Applications
3	28-Jan	Ch 2	Relativistic Mass, Momentum, Energy
	30-Jan		Mass Energy Equivalence
	1-Feb		Applications
4	4-Feb	Ch 3	Atoms, Molecules, Particles
	6-Feb		Avogadro number, Discovery of Electron
	8-Feb		Applications
5	11-Feb	Ch 4	Blackbody Radiation, Photo electric effect
	13-Feb		Photo electric effect
	15-Feb	Checkpoint 1 (Ch 1, 2, 3)	
6	18-Feb		Compton effect, Wave Particle Duality
	20-Feb	Ch 5	Atomic Spectra
	22-Feb		Bohr Model
7	25-Feb	Ch 6	DeBroglie Hypothesis
	27-Feb		Wave Function
	1-Mar		Heisenberg's Uncertainty Relation
8	4-Mar	Spring Break	
	6-Mar		
	8-Mar		
9	11-Mar	Ch 7	Standing waves
	13-Mar		Particle in a Box
	15-Mar		TISE
10	18-Mar	Ch 7	Expectation Values
	20-Mar		Barrier penetration
	22-Mar		Applications
11	25-Mar	Ch 9	Magnetic Spins
	27-Mar		Magnetic Moments
	29-Mar	Checkpoint 2 (Ch 4, 5,6, 7)	
12	1-Apr	Ch 10	Pauli's Exclusion Principle
	3-Apr		Periodic Table
	5-Apr		Applications
13	8-Apr	Ch 18	Structure of Matter
	10-Apr		Standard Model
	12-Apr		Beyond Standard Model -Higgs and Gravitons
14	15-Apr		Modern Cosmology, Applications
	17-Apr	Checkpoint 3 (Ch 9, 10, 18)	
	19-Apr	Good Friday	
15	22-Apr		Review
16	29-Apr		Final Exam (2-5 pm)