Phys 390 Quantum Mechanics 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 8:00-8:30pm
Additional Hours: By Appointment

Lectures: Block 3 MWF 10:40-11:40 am

Required Textbook: *Introduction to Quantum Mechanics* by David J. Griffiths 2nd Edition

Recommended:

- Ohanian, Hans. *Principles of Quantum Mechanics*. Upper Saddle River, NJ: Prentice Hall, 1989. ISBN: 0137127952.
- Feynman, R. P. *Feynman Lectures On Physics*. Vol. 3. Reading, MA: Addison Wesley Longman, 1970. ISBN: 0201021153.
- Cohen-Tannoudji, Claude. *Quantum Mechanics*. 2 vols. New York, NY: Wiley, 1977. ISBN: 0471164321.
- Gasiorowicz, Stephen. *Quantum Physics*. 3rd ed. Hoboken, NJ: Wiley, 2003. ISBN: 0471429457.

Course overview and learning outcomes:

This course will introduce the fundamental ideas of quantum mechanics. We will develop the mathematical techniques necessary to understand and explore physical systems. Upon completion of this course, successful students will be able to apply analytical and numerical treatment of non-relativistic theory in the interpretation of the wave function, the solution of the Schrodinger Equation for systems such as the harmonic oscillator and the hydrogen atom, and approximation methods for treating more complex systems. The students will develop competence in understanding the formalism of the following topics

- Ch 1 The Wavefunction (Jan 14-Jan 25)
- Ch 2 Time independent Schrödinger Equation (Jan 28-Feb 22)
    - Particles in Potentials
    - The Free Particle
    - Time dependent Schrödinger Equation
- Ch 3 Formalism (Feb 25- Mar 15)
    - Function Spaces
    - Operators and Eigenvectors
    - The Uncertainty Principle
- Ch 4 Quantum Mechanics in Three Dimensions (Mar 18-April 18)
    - Spherical Coordinates
    - The Hydrogen Atom
    - Angular Momentum
    - Spin
    - Applications

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

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 almost each lecture day. 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. One low homework grade will be dropped at the end.

Bi-Weekly Checkpoints (WCP): These bi-weekly checkpoints are used to assess your progress in understanding the materials, physics ideas and problems presented in lecture and homework. It is a fancy word for quiz. You can expect a WCP every other 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 two assessments of your understanding of the materials 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 measure 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 up with your daily learning. These CPs are scheduled roughly one and half month apart and will be held in class. The first CP is tentatively scheduled on Friday, March 1st, 2019 and the second one is on Wednesday, April 17, 2019. 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! Exam date is posted on Registrar's website and will be on Monday, April 29th from 8.30-11.30am.

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 8-8.30pm. 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.

MCSP Colloquium: You are required to attend at least 3 of the several talks as a part of the MCSP colloquia this fall. You have to write a paper on your reflections of the talk to get credit. MCSP reflection papers will count toward in-class participation grade. The reflection papers are typically due within one week from the day of the talk. If you show up for the talk and not submit the paper you will get 1 point. A well written reflection paper will earn you full credit of 3 points. MCSP points will be added to the final exam grade. This will be useful to swing the grade needle in your favor especially if your on the cusp of a +/-

Grading:

Homework	15 %
Interim Checkpoints (CP)	30% (15% each)
Weekly Checkpoints (WCP)	10%
In-class problems	10%
Participation and enthusiasm	5%
Final exam	30%

Inquire: Log-in to Inquire program via MyRC web portal on the College website. This will give you access to the syllabus, office hours schedules, lecture notes, any class announcements and a bunch of other stuff. Regular updates will be available posted here. Make sure to check the Inquire website regularly!!! No excuses can be made and no extensions can be granted if you miss a deadline that was posted on Inquire.

Disclaimer: Everything above is subject to change with notice and, where appropriate, your approval.