

Physics 114

Quantum Physics

I. Introduction

Welcome to the course Phy114, which is going to be your first exposure to this fascinating subject. As we progress, you will see that you have to leave aside a lot of concepts that you have learnt in physics so far. We will take you on this journey exposing you first to how things behave differently in the quantum regime. Having created this quantum world for you, we will then develop the related formalism and apply it. The following is the tentative sequence of topics to be covered:

Lectures 1-2: General Introduction

Lectures 3-12: The quantum world / The world is quantum mechanical.

In these lectures various natural phenomena related to mechanics, electricity and magnetism, optics and thermal physics will be discussed. These will give you a glimpse of how nature acts quantum mechanically.

Lectures 13-15: Steps towards quantum mechanics

Here we will combine different Things learnt so to make a bridge between classical and quantum mechanics.

Lectures 16-22: The quantum formalism

These lectures present the quantum formalism. First, we present the magical paper by Heisenberg that gave the first version of quantum mechanics, known as matrix mechanics. We then present beautiful development of the second version of the theory, known as wave mechanics, given by Schrödinger. The second version is the one that made quantum mechanics widely applicable by solving a differential equation – the Schrödinger wave equation.

Lectures 23-32: Applying quantum formalism.

Quantum mechanical formalism will not be applied to various systems to obtain their properties.

Lectures 33 onwards: Looking into the future.

Discussion on designing new materials, quantum cryptography and quantum computation.

II. Expectations from you:

What is expected from you during the course is to keep your mind open to new ideas, discuss them among each other and with the instructor, tutors and Teaching Assistants (TAs) of the course. Keep your focus on understanding these ideas and what thinking went into coming up with them. To help you carry on a discussion, we have a forum on MOOKit where such discussions can take place. To help you further in that process, we will form a group of 5-6 students each and ask each group to submit solved problems from the Assignments each week. These problems will be assessed by TAs and will be returned with comments on your work. While submitting these, *you must write at the beginning who among the group members contributed to solving the problems and how much.*

III. Evaluation

At IIT Kanpur, we follow the process of continuous evaluation (*from your side therefore you should follow the process of continuous study otherwise you may not be able to do well at IIT Kanpur*). Thus, your performance in the course will be evaluated on the basis of Assignments problems to be solved by you, 5 to 6 unannounced short quizzes (these will be taken in the tutorials and you will get 10-15 minutes to solve these), one Mid-semester examination of 2 hours duration and one End-semester examination that will be held for three hours. The tentative weightage for each of these is as follows (it may be changed by up to 5% for each evaluation component, if a need is felt for that):

Quizzes	60 Marks (24%)
Mid-semester examination	60 Marks (24%)
Assignment problems	40 Marks (16%)
End-semester examination	90 Marks (36%)
Total	250 Marks

The grading is going to be relative so do not get unnecessarily concerned if you score low in absolute terms. As long as you are putting in honest effort in learning, you will finally see that your grade will reflect that. Similarly, do not get worried if your performance in a quiz or in

Mid-semester is not up to the mark. Since we are doing continuous evaluation, you always have a chance to make up.

No make-up will be given for any missed quiz, nor will it be prorated. If you miss the mid-semester or end-semester examination for genuine reasons, a make-up will be given at a suitable time for the mid-semester examination and at the time fixed by the timetable for the end-semester make-up examination. The final decision on these matters will be taken by the instructor in consultation with the tutors.

IV. Interacting with the team

We would like to encourage you to interact with the instructor and tutors. Please also interact with the TAs as much as you can through the forum. Do not hesitate in asking questions. Keep in mind that a question is never silly or stupid but answers can be so; If someone tells you that you are asking a silly question, they are not being fair.

Enjoy the course and give it your best. A good thing about academics at IIT Kanpur is that honest effort always gets rewarded, and by the same token, lack of dedication does not.

Best wishes,
Manoj Harbola