

UNIVERSITY OF HYDERABAD
School of Physics

Jul 2010 - Dec 2010
M.Sc. III-Semester

Quantum Mechanics-II

Time : 30 Mins
MM : 20

Session X::Group Activity

Note: The members of each group to discuss the paper for 15 minutes and then each student must write the answer separately.

- ⊙ Read the following passage. The passage contains several parts in italics each identified with a label put inside a box. You have to answer a question related to each such part of the text given below.

In quantum mechanics the dynamical variables are represented by operators. In general the operators the operators do not commute and they have to be handled *with care* [1]. The non-commuting nature of the operators has *physical consequences* [??] as well. Whether two operators commute or not can be found by *several methods* [??] available for computing the commutators. When a set of operators commute, they have some important *mathematical properties* [??] which are very helpful in setting up an *important scheme* [??] for writing equations in quantum mechanics. The commutator being zero is frequently a great help in simplifying *computations* [??] on many occasions. Special form $[X, Y] = cY$ [??] is often very useful in finding *eigenvalues and matrix elements* [??]. The observables which commute with the Hamiltonian have a very special *status* [??]. **Some** of these operators represent a *commonly known quantity* [??] associated with energy levels of quantum system. The commutator of angular momentum operators being zero or non-zero can often be found by *inspection* [??] and is related to *rotations of the coordinate system* [??]. The commutators of the different operators can be computed once a few *basic commutators* [??] are specified. The information on these basics commutators is very important and constitutes *one of the assumptions* [??] of quantum mechanics. quantum mechanics. The non-zero value of the basic commutators can be traced to a *famous principle* [??] given by a *famous physicist* [??].

- ⊙ Answer the following questions about the portions of the above passage marked with the corresponding label.

- [1] Give an example where not being careful leads to a wrong answer.
- [2] I2 Mention some physical consequences.
- [3] I3 Briefly describe different methods with example. Do not give too much computational details.
- [4] I4 What are these mathematical properties?
- [5] I5 What scheme is hinted at and why is it important?
- [6] I6 Give an example of a computation which gets simplified.

- [7] I7 Give an example you may have seen of commutator of this form with $c \neq 0$.
- [8] I8 What example of computing eigenvalues can be cited as an example here?
- [9] I9 Explain the special status and mention a few examples.
- [10] I10 What is the name common for the class hinted here.
- [11] I11 Give an example where the commutator can be found by inspection.
- [12] I12 Explain what is the role of rotations here?
- [13] I13 Write these basic commutators for a particle in three dimensions.
- [14] I14 Which postulate is being referred here?
- [15] I15 What is this famous principle?
- [16] I16 Name this famous physicist?