Course Code	CSE622
Course Name	Introduction to Quantum Computing
Credits	4
Course Offered to	UG+PG
Course Description	This is an introductory course about designing solutions for computation problems using the quantum computing models. It has been shown that these models allow us to solve certain problems more efficiently compared to classical platforms (like Digital circuits or Turing machines). On the other hand, there are certain scenarios where this model is siimlar or even worse than classical platforms. In this course a student will learn about the models and interesting solutions (circuits, algorithms) for some problems from the perspective of computer science. The first half of the course will introduce the postulates of quantum computing, operations and operators and basic structure of circuits and algorithms on the circuit model and the Turing machine model. We will also cover some simple but amazing solutions like quantum teleportation, super-dense coding and Deutsch-Jozsa algorithm. The second half of the course will cover important algorithmic tools like the quantum Fourier transformation, amplitude amplification and eigenvalue estimation and discuss important algorithms like Grover's search, Shor's factoring, BB84 protocol which bring significant efficiency compared to classical algorithms. Depending upon time and interest, some recent advances will be covered. Students may have to read a recent/classical research paper and/or simulate some of their algorithms and circuits on some quantum circuit simulator (e.g., Microsoft LIQUi simulator) to get a better feel about the system.

Pre-requisites		
Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
Linear Algebra	Probability and Statistics, Analysis and Design of Algorithms	

*Please insert more rows if required

Post Conditions*(For suggestions on verbs please refer the second sheet)			
CO1	**CO2**	**CO3**	**CO4**
Students are able to understand the principles of quantum computing	Students are able to understand different quantum computing models used in different applications like search, numerical algorithms, cryptography, etc.	Students are able to Design and/or analyse quantum algorithms and circuits.	Students are able to explain and/or implement simple algorithms and circuits from research papers

Weekly Lecture Plan			
Week Number	**Lecture Topic**	**COs Met**	**Assignment/Labs/Tutorial**
1	Principles of quantum computing	CO1	
2			
3			
4	Models of quantum computing	CO2	
5			

6	Simple circuits and algorithms	CO3	Written homeworks and/or simulator-based exercises
7	Amplitude Amplification based algorithms	CO3	
8	Quantum Fourier Transform based algorithms	CO3	
9			
10	Quantum Cryptography and other topics, paper presentation/report submission	CO4	
11			
12-13	Advanced topics		

*Please insert more rows if required

Weekly Lab Plan			
Week Number	**Laboratory Exercise**	**COs Met**	**Platform (Hardware/Software)**

*Please insert more rows if required

Assessment Plan	
Type of Evaluation	**% Contribution in Grade**
End Sem	35-40
Mid Sem	30-35
Paper Reading	10
Quizes and Homework	20-Oct

*Please insert more row for other type of Evaluation

Resource Material	
Type	**Title**
Textbook	Michael Nielsen and Isaac Chuang. Quantum Computation and Quantum Information
	* [KLM] Kaye, Laflamme and Mosca, An Introduction to Quantum Computing