INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
भारतीय प्रौद्योगिकी संस्थान तिरुपति

1.	Title of the course	Introduction to Quantum Entanglement and Quantum Computing
2.	Course number	PH513L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To PH5021/17
6.	To be offered by	Department of Physics
7.	To take effect from	July 2022
8.	Prerequisite	CoT
9.	**Course Objective(s):** To provide an introduction to fundamental concepts of quantum theory, including the path integral formulation and to introduce the principles of quantum entanglement and quantum computing. An understanding of quantum gates will be developed. The course will prepare students from different backgrounds to study quantum computing.	
10.	**Course Content:** Description of a mechanical system in classical and quantum physics, classical vs. quantum uncertainty; Quantum entanglement, Einstein-Podolsky-Rosen paradox, correlations in quantum measurements, Bell's inequalities; Classical vs. quantum computing, brief review of classical logic gates, bits vs. qubits, Bloch sphere description of qubits; Universal quantum logic gates, Pauli gates, Hadamard gate, Swap gate etc.; Physical qubits; Multi-qubit quantum gates; Complete solution to Deutsch-Jozsa algorithm, introduction to Grover and Shor algorithm, no-cloning theorem and quantum teleportation, quantum dense coding, quantum cryptography; Time-delay in quantum information processing; Race for quantum supremacy; Recent advancements toward realization of quantum communication and computation protocols.	
11.	**Textbook(s):** 1. Nielson M A and Chuang I L, *Quantum Computation and Quantum Information*, 2nd Edition, Cambridge University Press (2010). 2. Steeb W and Hardy Y, *Problems and Solutions in Quantum Computing and Quantum Information*, 4th Edition, World Scientific (2020).	
12.	**Reference(s):** 1. Griffiths D J and Schroeter D F, *Introduction to Quantum Mechanics*, 3rd Edition, Cambridge University Press (2018). 2. Kisak P F, *Quantum Entanglement*, 1st Edition, CreateSpace Independent Publishing Platform (2016).	