Indian Institute of Technology Kanpur
Physics Department

1. Course No: PHY 676
2. Course Title: **Quantum Technology**
3. Per Week Lectures: 2 (L), Credits (3-0-0-0):9; Duration of Course: Full semester
4. Proposing Department: Department of Physics
   Other Departments/IDPs which may be interested in the proposed course: Institute Open Elective
5. Other faculty members interested in teaching: Prof. Saikat Ghosh & Prof. Adhip Agarwal
6. Instructor(s): Sapam Ranjita Chanu
7. Course Description:

A) Objectives: This course aims to introduce students with a grounding in the new discipline of quantum information and quantum computing using quantum mechanics, atomic physics, computations and engineering. Students who graduate from this program will have the knowledge to succeed as researchers or program managers in a quantum computing or quantum technologies enterprise.

B) Contents (preferably in the form of 4 broad titles):

Sl. No	Topic	Lectures
1	**Introduction to quantum technologies** - why do we need quantum technologies and its application to understand experimental results - Various platform for implementing Quantum Technology & design robust quantum devices	4
2	**Fundamental understanding of Quantum Behaviour** - Quantum mechanics, entanglement, superposition, decoherence in open quantum systems, quantum information, quantum noise and quantum error correction theory	14
3	**Understanding engineering challenge of present developers and implementation on various sub-domain** - Quantum limited sensing - Quantum non-destructive measurement and Metrology - Quantum communication - Macroscopic quantum systems, - Quantum optics, cold atoms and ions - Quantum microwaves - Quantum materials	20
4	**Scientific limitation of quantum algorithms and simulation of physics and optimization-atoms and ions-** case studies with few literature	2

Lecture-wise break-up (considering the duration of each lecture is 50 minutes)

C) **Recommended pre-requisites Instructor's consent**; Quantum mechanics, Atomic and Molecular Optical Physics is preferable.

8. **Recommended text/reference books**:

A . "The Second Quantum Revolution: From Entanglement to Quantum Computing and Other Super-Technologies, Lars Jaeger, Springer (2016)

B."Quantum computation and Quantum Information", Nielson & Chuang, Cambridge Press (2013)

C. "Introduction to Quantum Technologies", Alto Osada, R. Yamazaki, A Noguchi, Springer (2022)

Any other remarks:

a. Open to senior UG and PG students.