

**ACADEMIC AFFAIRS OFFICE  
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./1200/IAPC-98

Dated: March 08, 2021

**CORRIGENDUM**

The IAPC in its 98<sup>th</sup> meeting held on 03.02.2021 vide Item No. 98.2.2 approved the proposal of Department of Physics to introduce a new pre-Ph.D. course i.e., PHN-901: Introduction to Quantum Information and Computation.

As corrigendum to the said course, the code of the course PHN-901 shall now be read as **PHN-921**. The amended syllabus is available at following link:

[https://www.iitr.ac.in/academics/uploads/98.2.2\\_PHN-901.pdf](https://www.iitr.ac.in/academics/uploads/98.2.2_PHN-901.pdf)



**Assistant Registrar (Curriculum)**

**Copy to (through e mail):-**

1. All faculty
2. All Head of Departments/Centres
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs(Curriculum)
5. Channel I/ Academic webpage of iitr.ac.in/ acad portal

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE:** Department of Physics

1. **Subject Code:** PHN-921      **Course Title:** Introduction to Quantum Computation and Information
2. **Contact Hours:**      **L:** 3      **T:** 1      **P:** 0
3. **Examination Duration (Hrs.):**      **Theory:** 3      **Practical:** 0
4. **Relative Weightage:**    **CWS:** 20-35    **PRS:** 0    **MTE:** 20-30    **ETE:** 40-50    **PRE:** 0
5. **Credits:** 4      6. **Semester:** Both      7. **Subject Area:** PEC
8. **Pre-requisite:** A knowledge of graduate level quantum mechanics is essential.
9. **Objective:** The course covers the foundations of quantum information and selected topics in quantum communication and quantum computation, including physical implementations.

### 10. Details of the Course

S.No.	Contents	Contact hours
1.	Introduction, postulates of quantum theory, quantum circuit model, Super-dense coding, quantum teleportation and no-cloning theorem.	6
2.	Quantum computing: Quantum qubits, quantum logic gates, Quantum Circuits, Universal quantum gates, application of quantum computer; Deutsche's algorithm, Deutsch-Jozsa algorithm, Simon's Algorithm.	12
3.	Quantum Fourier Transform, Grover's algorithm, Phase estimation, Quantum Factorization, Shor's algorithm, Quantum search algorithms, Quantum error-correction, Quantum error-correcting codes, Stabilizer codes, Fault-tolerant quantum computation.	15
4.	Physical realizations of quantum computation using trapped atoms and ions, spintronics and superconducting qubits. quantum communication protocols.	9
<b>Total</b>		<b>42</b>

### 11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Michael A Nielsen and Isaac Chuang, "Quantum computation and quantum information", Cambridge University Press.	2012
2.	Phillip Kaye, Raymond Laflamme and Michele Mosca, "An Introduction to Quantum Computing", Oxford University Press.	2007
3.	N. David Mermin, "Quantum Computer Science An Introduction" Cambridge University Press	2007
4.	Noson S. Yanofsky and Mirco A. Mannucci "Quantum Computing for Computer Scientists" Cambridge University Press	2008
5.	John Watrous "The Theory of Quantum Information" Cambridge University Press	2018
6.	John Preskill, Lecture notes of Physics 219: Quantum Computation, <a href="http://theory.caltech.edu/~preskill/ph229/">http://theory.caltech.edu/~preskill/ph229/</a> (Formerly Physics 229)	-

**ACADEMIC AFFAIRS OFFICE  
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./876/IAPC-98

Dated: February 17, 2021

**Head, Department of Physics**

The IAPC in its 98<sup>th</sup> meeting held on 03.02.2021 vide Item No. 98.2.2 considered the proposal of Department of Physics to introduce a new pre-Ph.D. course i.e., PHN-901: Introduction to Quantum Information and Computation.

The IAPC recommended the proposal with minor modifications. Duly modified syllabus is attached as **Appendix-A**.

  
**Assistant Registrar (Curriculum)**

**Encl:** as above

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