



**FIRST SEMESTER 2015-2016**

**COURSE HANDOUT (PART II)**

Date: 03/08/2015

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

**Course Number:** BITS F386

**Course Title:** Introduction to Quantum Information and Computation

**Instructor-in-Charge:** Jayendra N. Bandyopadhyay

**Scope & Objectives:** This is an introductory course on a rapidly developing interdisciplinary field. Students from different disciplines will get opportunity to exchange ideas, which help them to develop base for advanced studies in many other interdisciplinary fields.

**Course Description:** This course is divided into three parts. (1) *Foundation*: Basic ideas and interpretation of quantum mechanics relevant for understanding quantum information. (2) *Quantum Computation*: Quantum circuit model, quantum gates, and quantum algorithms. (3) *Quantum Information*: Quantum version of Shannon's classical theory of information, quantum cryptography, error correction, etc.

**Books:**

**(I) Textbook:** Quantum Computation and Quantum Information, M. A. Nielsen and I. L. Chuang, Cambridge Univ. Press 2002 (TB)

**(II) Reference books:**

(a) Principles of Quantum Computation and Information, Vols. 1 & 2, G. Benenti, G. Casati, and G. Strini, World Scientific, 2007

(b) Quantum Theory: Concepts and Methods, A. Peres, Kluwer Academic Publishers, 1999

**Course Plan:**

Lec. #	Learning Objectives	Topics to be covered	Chap./Sec.
1	Introduction & Overview	-----	----





2-13	Foundations	Postulates of quantum mechanics, qubits, Bloch sphere, composite systems (density matrix, partial trace), entanglement (Schmidt decomposition), quantum eraser (GHJW theorem), EPR pairs, Bell and CHSH inequalities, No cloning theorem	TB Chap. 1-2
14-24	Quantum computation	Quantum circuit model and quantum gates, controlled gates, universal set of gates, superdense coding, teleportation, quantum algorithms (Deutsch, Deutsch-Jozsa, Shor, Grover)	TB Chap. 4-6
25-40	Quantum information	Shannon's coding theorem, Schumacher's quantum version, mathematical properties of von Neumann and relative entropy, Holevo bound, quantum error correction, quantum cryptography	TB Chap. 10-12

**Evaluation Scheme:**

No.	Evaluation Component	Duration	Weightage	Date & Time
1	Tutorials/Assignments/Seminars	-----	30%	
2	Mid-Term (Close book)	90 Mins	30%	8/10 8:00 - 9:30 AM
3	Comprehensive Exam. (Open*+Close book)	3 Hrs	40%	8/12 FN

**\*Open Book:** Only the books listed in the handout and handwritten notes are allowed.

**Chamber Consultation Hours:** To be announced in the class.

**Notices:** Will be uploaded on Intrabits site only.

**Make-up Policy:** Make-up will be given only in genuine cases, that is, illness leading to hospitalization or going out of station with prior permission. No make-ups for the tutorials.





BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani  
Pilani Campus  
Instruction Division

---

Instructor-in-charge



Please Do Not Print Unless Necessary

