

**B.TECH. IN ELECTRONICS AND  
COMMUNICATION ENGINEERING (BTECVI)**

**Term-End Examination**

**December, 2013**

**BIELE-009 : QUANTUM COMMUNICATION**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt any seven questions. All questions carry equal marks. Missing data may be suitably assumed.*

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1. Define the following terms as applicable to quantum communication : 2x5=10
  - (a) Hilbert Space
  - (b) Density Matrix
  - (c) Projective Measurement
  - (d) Pure State
  - (e) Mixed State
  
2. Explain the following : 5x2=10
  - (a) Stinespring Theorem.
  - (b) Kraus Representation Theorem.
  
3. Explain the procedure involved in the transmission of classical information over quantum channels. 10

4. What do you understand by the term “VON NEUMAN ENTROPY” ? Explain the above with suitable example. 10
5. What are the various connections between compression ideas and communication channel capacities ? Explain in brief. 10
6. What do you understand by the term “ENTANGLEMENT” and “QUANTUM CHANNEL CAPACITY” ? Explain the role of entanglement in calculating quantum channel capacity. 10
7. Explain in detail stabilizer code construction technique. 10
8. With the help of suitable example explain how SHOR 9 QUBIT CODE protect against bit flips and phase flips ? 10
9. Mathematically establish a relation between mixed state compression and Holevo’s theorem. 10
10. Write short notes on **any two** : 5x2=10
  - (a) Scaling issues in Hilbert space.
  - (b) Heisenberg uncertainty principle.
  - (c) Partial Trace Operator.