



School of Electrical Engineering  
Sharif University of Technology

## Photonic Crystals

Final Exam, June 20, 2016, Time: 90 Minutes, Open Book

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- 1) Consider a one-dimensional photonic crystal with simple non-dispersive dielectrics. Obtain a relation for phase velocity of waves in the long wavelength regime for E- and H-polarizations.
    - a) Extend the results for in-plane propagation in a two-dimensional photonic crystal.
    - b) Obtain an approximate relationship for the cut-off frequency if the two-dimensional photonic crystal has a triangular or square lattice geometry with circular holes, filled out with lossless Drude metals.
  - 2) Describe the conditions under which the irreducible Brillouin zone becomes exactly the same as the first Brillouin zone.
  - 3) Consider a square supercrystal (coupled photonic cavity resonator array) embedded in a simple two-dimensional photonic crystal using double degenerate cavities. Obtain the approximate band structure if only the first nearest neighbors are taken into account.
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Good Luck