

## EE 207, Quiz 1

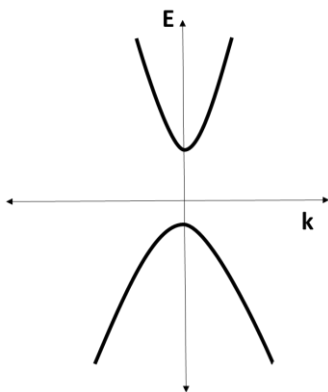
(Total marks: 10, Closed book exam)

Roll Number:

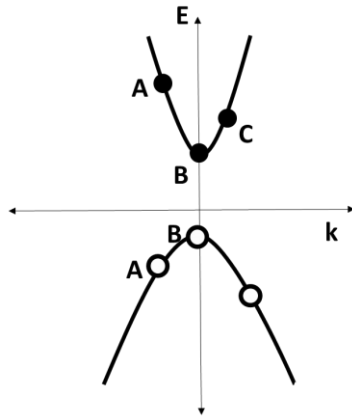
In case of any ambiguity or apparent inconsistency or missing parameters, DON'T ASK. State your assumptions and solve the problem accordingly.

**Question 1.** Illustrate a plane with miller indices (3,5,2) in three dimensional coordinate system (1 mark). What would be the representation of a vector normal to that plane as per miller system (1 mark).

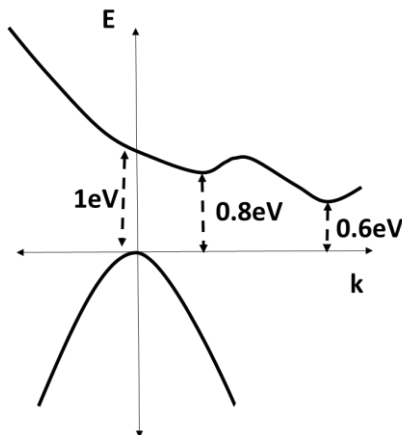
**Question 2.** For the E-k diagram shown below, compare the effective mass of electrons in the bottom of conduction band and holes in the top of valence band (1 mark). Is the transition of an electron from the top of valence band to the bottom of conduction band allowed as per the law of conservation of mass (1 mark).



**Question 3.** Arrange the electrons and holes in the E-k diagram shown below in an ascending order of their energy (2 marks).



**Question 4.** For the E-k diagram shown below, provide the corresponding energy band diagram with respect to spatial coordinates. Also mention the band gap (2 marks)



**Question 5.** A 1D crystal consist of 1500 atoms with an interatomic spacing of 0.4nm. Assume each atom contributes 3 electrons each to the system.

(a) What would be the total number of allowed states in each sub band of the E-k dispersion as per the Kronig-Penney model (1 mark).

(b) comment on the nature of the material - whether metallic/semiconductor/insulator and why (1 mark).