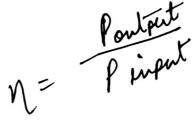
PYV428/EPV450 Selected Topics in Nanotechnology MAJOR

Date: 10.05.2016 Duration: 2 hrs

Full marks: 40

Attempt all questions



Q1. A] Draw a neat schematic and of process steps of nanoimprint lithography (NIL) with a **brief description**. What is the advantage of NIL over photolithography technique?

B] For same tip and surface system two circular nanodots are fabricated. The dwell time for dot 1 is 4 times than that of dot 2. Compare the sizes of the dots. Draw pushing and sliding modes current profiles with STM (no description).

[5+1+2+2=10]

Q2. A] Draw I-V characteristics of a PV solar cell in dark and illuminated condition and define **fill factor** and **efficiency** from that. In a schottky barrier type solar cell, why metal-insulator-semiconductor (MIS) interface is better than a metal-semiconductor (MS) interface? Give reason with appropriate mathematical equation.

B] Draw schematic of a solar cell with metal nanoparticle decoration at the top, illustrating how solar radiation is confined in the active medium. Why the radiation is confined? \checkmark [4 + 2 + 4 = 10]

Q3. A] Why a metal semiconductor junction is not practically useful as a base material for spintronic devices? How diluted magnetic semiconductor overcome this difficulty? What is the difference between 'carrier mediated exchange Interaction and 'bound magnetic polaron' models?

B] For Magnetic-NM-Magnetic ultrathin layer, show schematically the conduction of electron as per 'two resistor' model for parallel and anti parallel cases and show that,

GMR =
$$(r. + r_{+})^{2} / 4r_{+}r_{-}$$
 [5 + 5 = 10]

Q4. A] Define 'chiral vector' for a carbon nanotube. Based on this physical quantity, how CNTs can be classified in three groups?

B] Draw neat sketches of I-V characteristics of **electron field emission** and define 'threshold field. How F-N equation can be used to determine 'field enhancement factor'? Large number of random nanotubes gives much less current than even few well separated nanotubes. Why? [4 + 2 + 2 + 2 = 10]

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