MAJOR

Elements of Materials Processing (PYL116)

Time: 70 minutes | **6 May, 2016 (10:50 AM)** | **Max. Marks: 25**

About the optional quiz, **QUIZ-4**

- ❑ The optional quiz Q4 (10 Marks) will be held **today after** collecting the Major answer-scripts **(i.e., around 12:00 noon today)**
- ❑ Those who write Q4, their **lowest scored quiz marks** (out of Q1 or Q2) will **compulsorily be replaced** with the marks scored in Q4.
- ❑ Attendance will be taken separately for Q4.

1. The RHEED oscillations are not observed below a certain temperature. Why? 2
2. Derive the expression of **biaxial** stress present in a film (thickness d_f) deposited on a substrate of thickness d_s (assume $d_s >> d_f$) in terms of the radius of curvature R of the film. 5
3. In a RHEED pattern obtained using an e-beam of energy 50 keV, the central and the adjacent streaks are found to be 5 mm distance apart. If the RHEED screen is located 20 cm away from the film, find the interatomic spacing (in Å) on the surface of the growing film. 3
4. Why the conventional MBE is less suitable for growing epitaxial quality III-V phosphide thin films? What is the solution to this problem? 2
5. Prove that the cathode target, in case of RF-sputtering, bias itself negatively for most of the time. 4
6. Discuss the origin of the hysteresis observed in the plot of target voltage as a function of reactive gas flow rate in a reactive sputtering pressure. 3
7. What is Paschen's Law? Discuss the reasons that suggest that there is always an optimum pressure needed for striking and sustaining the glow discharge plasma. 3
8. Differentiate between the *positive* and *negative* photoresists. Also discuss the origin of such a difference. 3

Constants: $k_B = 1.38 \times 10^{-23}$ J/K, R=1.987 cal/mol/K (=8.31451 J/K/mol); h=6.6 x 10^{-34}J-s