# Answer Sheet for Part A                              APhO 2002

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|      |             |         |         |                   |

(1) : <u>Determine the plane of polarization of the incident laser light</u>.

   *(a) Relative orientation of diode laser and polarizer (difference in degree between the angular settings of the diode laser rotary stage and the polarizer rotary stage)*

   *The difference in the two angles (in degree)  =* _____          *(0.2 point)*

   *(b) Brewster angle of incidence $_i$ for the glass plate =* _____          *(0.2 point)*

   *Submit data on blank sheet*

   *Graph of reflected laser power versus angular setting of the polarizer rotary stage*

                                                                       *(0.4 point)*
   *Angular setting of the polarizer rotary stage
       for axis of polarization parallel to the plane of incidence =* _____
                                                                       *(0.2 point)*

(2): <u>Measure the reflectance $R_p$ and $R_s$ of the semiconductor wafer</u>

   *(a) Reflectance $R_p$ (plane of polarization parallel to the plane of incidence)*

   *Parameters of your instrument:*
   *(i)    Angular setting of the polarizer rotary stage   =* _____
   *(ii)   Angular setting of the diode laser rotary stage =* _____
   *(iii)  Measured incidence laser power $I_i$ =* _____*(mW)*          *(no point)*

   *Measurement, calculation of $R_p$
   and graph of $R_p$ versus incident angle*                              *(3 points)*

   *(b) Reflectance $R_s$ (plane of polarization perpendicular to the plane of incidence)*

   *Parameters of your instrument:*
   *(i)    Angular setting of the polarizer rotary stage   =* _____
   *(ii)   Angular setting of the diode laser rotary stage =* _____
   *(iii)  Measured incidence laser power $I_i$ =* _____*(mW)*          *(no point)*

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*Measurement, calculation of $R_s$*
*and graph of $R_s$ versu incident angle*  (2 points)

(3): Calculate the refractive index of the semiconductor sample

(a)  *Derivation of equation relating the refractive index n to $\pm \sqrt{R_p}$ and $\sqrt{R_s}$*
        *(Submit derivation on blank sheet)*

        (0.5  point)


*The sign (s) of $\pm \sqrt{R_p}$ :*  _____

                                    _____

                                                            (0.5 point)

(b)  *Six values of n*

| angle of incidence $_\iota$ | $R_p$ | $R_s$ | $n$ |
|---|---|---|---|
| 20 | | | |
| 30 | | | |
| 40 | | | |
| 50 | | | |
| 60 | | | |
| 80 | | | |

                                                            (2 points)

*Mean and standard deviation $_n$ for n*

> *n (mean) =*
>    $_n =$

                                                            (0.4 point)

(c)  *Reflectance $R_s$ and $R_p$ of the semiconductor at normal incidence.*

> $R_s =$         %
> $R_p =$         %

        *Refractive index n =*  _____        (0.6 point)