LIST OF SYMBOLS, NOTATIONS AND ABBREVIATIONS

SYMBOLS AND NOTATIONS

CHAPTER 1

$\epsilon'$ - permittivity
$N$ - average (total) electron density
$P$ - average (total) hole density
$E_g$ - band gap energy
$E_v$ - valence band energy level (active layer)
$E_c$ - conduction band energy level (active layer)
$F_c$ - electron Fermi level
$F_v$ - hole Fermi level
$q$ - electronic charge
$V_j$ - diode junction voltage
$K$ - boltzmann's constant
$T$ - absolute temperature
$N_c$ - conduction band effective density of states
$N_v$ - valence band effective density of states
$N_A$ - acceptor impurity concentration
$N_{A}^\prime$ - concentration of ionised acceptors
$\gamma$ - constant
$P_o$ - equilibrium hole density
$N_o$ - equilibrium electron density
$n$ - excess electron density
$P$ - excess photon density
$r_n$ - non radiative recombination life time
$r_s$ - low-level injection spontaneous recombination life time
$A$ - area of diode contact stripe
$d$ - thickness of diode active layer
$I_{01}$, $I_{02}$ - diode leakage current

$R_e$ - equivalent resistance due to carrier degeneracy
$C_s$ - diode space charge capacitance
$R_d$ - diode small signal resistance
$C_d$ - total diode capacitance
CHAPTER 2

\( \epsilon \) - gain compression factor
\( V_g \) - group velocity
\( a_0 \) - active layer gain coefficient
\( \phi \) - optical phase within the laser cavity
\( \alpha \) - line width enhancement factor
\( q \) - electron charge

CHAPTER 3 & 4

\( n \) - charge density in the quantum well
\( p \) - photon density
\( J \) - injected current density
\( B \) - conventional band-to-band recombination coefficient
\( \Gamma \) - optical confinement factor
\( g_m \) - optical gain
\( V_g \) - speed of light in the lasing medium
\( q \) - charge of an electron
\( N_w \) - number of quantum wells
\( L_z \) - thickness of a single quantum well
\( \beta \) - spontaneous emission coupling coefficient
\( r_p \) - photon life time
\( h \) - planck's constant, \( (h^* = h/2\pi) \)
\( E_{fc} \) - quasi-Fermi level in the conduction band
\( E_{fv} \) - quasi-Fermi level in the valence band
\( E_q \) - energy gap between two subbands
\( E_g \) - energy band gap of the laser material
\( E_{ph} \) - photon energy
\( \varepsilon_0 \) - permittivity of free space
\( C \) - speed of light in vacuum
\( \mu \) - refractive index
\( m^*_c \) - effective mass in the conduction band
\( m^*_v \) - effective mass in the valence band
\( m_e \) - mass of an electron
\( \omega \) - radial frequency
\( L \) - length of the laser
\( \alpha_1 \) - intrinsic loss
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_{nl}$</td>
<td>intrinsic loss for non-lasing mode</td>
</tr>
<tr>
<td>$B_{avg}$</td>
<td>effective spontaneous emission coupling coefficient for non-lasing mode</td>
</tr>
<tr>
<td>$\alpha_{sp}$</td>
<td>spontaneous emission coupling coefficient</td>
</tr>
<tr>
<td>$\alpha_{st}$</td>
<td>stimulated emission coupling coefficient</td>
</tr>
<tr>
<td>$W$</td>
<td>width of the metal contact on the laser</td>
</tr>
<tr>
<td>$R$</td>
<td>reflectivity</td>
</tr>
<tr>
<td>$E_{c1}$</td>
<td>energy level of the first conduction band</td>
</tr>
<tr>
<td>$E_{v1}$</td>
<td>energy level of the first valence band</td>
</tr>
<tr>
<td>$E_{c2}$</td>
<td>energy level of the second conduction band</td>
</tr>
<tr>
<td>$E_{v2}$</td>
<td>energy level of the second valence band</td>
</tr>
<tr>
<td>$N_b$</td>
<td>barrier/confineent region carrier number</td>
</tr>
<tr>
<td>$N_w$</td>
<td>well carrier number</td>
</tr>
<tr>
<td>$\tau_{sw}$</td>
<td>carrier life time in the wells</td>
</tr>
<tr>
<td>$\tau_{ab}$</td>
<td>effective life time in the barriers</td>
</tr>
<tr>
<td>$\tau_c$</td>
<td>quantum capture time</td>
</tr>
<tr>
<td>$J/e$</td>
<td>pumping rate of the constant current source</td>
</tr>
<tr>
<td>$\eta$</td>
<td>ratio of capture to release time</td>
</tr>
<tr>
<td>$L_G$</td>
<td>length of the SCH</td>
</tr>
</tbody>
</table>