## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table No</th>
<th>Title</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Measured value of nonlinear absorption coefficient $\beta$ and imaginary part of third order susceptibility $\text{Im} \left[ \chi^{(3)} \right]$ for silver nanoparticles in aqueous solution with different concentration of DNA at a typical fluence of 50 MW/cm$^2$</td>
<td>82</td>
</tr>
<tr>
<td>4.2</td>
<td>Measured value of nonlinear absorption coefficient $\beta$ and imaginary part of third order susceptibility $\text{Im} \left[ \chi^{(3)} \right]$ for silver nanoparticles in aqueous solution with different concentration of DNA at a typical fluence of 175 MW/cm$^2$</td>
<td>83</td>
</tr>
<tr>
<td>6.1</td>
<td>Band gap of semiconductor nanoparticles in DNA and BSA template</td>
<td>114</td>
</tr>
<tr>
<td>6.2</td>
<td>Particle size of nanoparticles in DNA and BSA template obtained from X- ray diffraction and optical absorption studies</td>
<td>115</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Fig. No</th>
<th>Title</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Confocal image of the worm Caenorhabditis elegas. Six luminous spots can be distinguished on the worm, representing the fluorescence yielded from the Green Fluorescent Protein (GFP) molecules</td>
<td>4</td>
</tr>
<tr>
<td>1.2</td>
<td>SEM micrograph of close packing of iridoviruses in a periodic structure.</td>
<td>6</td>
</tr>
<tr>
<td>1.3</td>
<td>Light-harvesting antenna-based dendritic structure (chemical structure). Antenna has three different Zn porphyrins: eight tetraphenyl Zn porphyrin units (TP-Por), four Zn porphyrin units with two meso-ethynyl and two meso-phenyl groups (DE-Por), and a Zn porphyrin unit with four meso-ethynyl groups (TE-Por)</td>
<td>7</td>
</tr>
<tr>
<td>1.4</td>
<td>Double helix structure of DNA</td>
<td>13</td>
</tr>
<tr>
<td>1.5</td>
<td>Back bone of double helix structure of DNA</td>
<td>14</td>
</tr>
<tr>
<td>1.6</td>
<td>Helical anionic polynucleotic backbone</td>
<td>15</td>
</tr>
<tr>
<td>1.7(a)</td>
<td>Different grooves present in DNA</td>
<td>15</td>
</tr>
<tr>
<td>1.7(b)</td>
<td>Intercalation and groove binding of DNA</td>
<td>15</td>
</tr>
<tr>
<td>2.1</td>
<td>Schematic diagram of two photon absorption</td>
<td>30</td>
</tr>
<tr>
<td>2.2</td>
<td>Schematic representation of the experimental set up for Z-scan technique</td>
<td>33</td>
</tr>
<tr>
<td>2.3</td>
<td>Absorption spectra of DNA in PVA at different temperatures</td>
<td>38</td>
</tr>
<tr>
<td>2.4</td>
<td>Open aperture Z-scan curve of and DNA in PVA solution at different temperatures</td>
<td>38</td>
</tr>
<tr>
<td>2.5</td>
<td>Absorption spectra of dye doped DNA-PVA solution</td>
<td>39</td>
</tr>
<tr>
<td>2.6</td>
<td>Open aperture Z-scan curve of Rhodamine 6G in Polyvinyl alcohol solution</td>
<td>41</td>
</tr>
<tr>
<td>2.7</td>
<td>Open aperture Z-scan curve of DNA (1 wt%) doped in Polyvinyl alcohol solution of Rhodamine 6G (Note a small dip in the transmission peak at the focal point.)</td>
<td>42</td>
</tr>
</tbody>
</table>
2.8 Open aperture Z-scan curve of DNA (2 wt%) doped Polyvinyl alcohol solution of Rhodamine 6G.

2.9 Open aperture Z-scan curve of polyvinyl alcohol solution (PVA) and DNA–PVA solution

2.10 Absorption spectra of dye doped DNA- PVA thin film

2.11 Open aperture Z-scan curve of DNA doped Rhodamine 6G Polyvinyl alcohol thin film of thickness 500 µm

3.1 Schematic diagram of experimental set up.

3.2 ASE from Rhodamine 6G (0.5x10^{-4} M) doped PVA for different pump intensities at excitation lengths of the pump beam 4mm. Where a, b, c, d, e, f are ASE spectrum at 1, 1.5, 2, 2.5, 3, 3.5 mJ respectively.

3.3 ASE from Rhodamine 6G (0.5x10^{-4} M) doped DNA-PVA for different pump intensities at excitation lengths of the pump beam 4mm. Where a, b, c, d, are ASE spectrum at 1, 1.5, 2, 2.5 mJ respectively.

3.4 ASE from Rhodamine 6G (1.5x10^{-4} M) doped PVA for different pump intensities at excitation lengths of the pump beam 4mm. Where a, b, c, d, e are ASE spectrum at 1, 1.5, 2, 2.5, 3 mJ respectively.

3.5 ASE from Rhodamine 6G (1.5x10^{-4} M) doped DNA-PVA for different pump intensities at excitation lengths of the pump beam 4mm. Where a, b, c, are ASE spectrum at 1, 1.5, 2, mJ respectively.

3.6 Shows the effect of DNA on the ASE from dye-DNA-PVA system, clear dependence of DNA on ASE in dye PVA is observed

3.7 Full width half maximum of ASE spectra vs pump intensity

3.8 ASE from Rhodamine 6G (1.5x10^{-3} M) doped PVA for different pump intensities at excitation lengths of the pump beam 4mm. Where a, b, c, d, e are ASE spectrum at 1, 1.5, 2, 2.5, 3 mJ respectively.
3.9 ASE from Rhodamine 6G (1.5x10^{-3} M) doped DNA-PVA for different pump intensities at excitation lengths of the pump beam 4mm. Where a, b, c, d, e are ASE spectrum at 1, 2, 2.5, 3 mJ respectively.

3.10 ASE from dye doped PVA-DNA thin film for different pump intensities.

3.11 Dependence of peak emission intensity of ASE on incident pump energy.

3.12 Laser modes with a spacing of 0.2 nm from a dye doped DNA–PVA thin film.

3.13 Line width of emission spectra at different pump energy levels.

3.14 Emission spectra from dye doped PVA thin film for different pump intensities.

4.1 Absorption spectra of silver nanoparticles in aqueous solution three concentrations of DNA. (Where C1, C2, C3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.2 SEM images of the silver nanoparticles synthesized with different concentration of DNA (A, B, C represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively).

4.3 Open aperture Z-scan curves of silver nanoparticles in aqueous solution with different concentration of DNA at a typical fluence of 50 MW/cm². (where C1, C2, C3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.4 Open aperture Z-scan curves of silver nanoparticles in aqueous solution with different concentration of DNA at a typical fluence of 175 MW/cm². (where C1, C2, C3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.5 Open aperture Z-scan curves of aqueous solution of DNA(0.05 wt%) at a typical fluence of 50 MW/cm² and 100 MW/cm².
4.6 Optical limiting performance of silver nanoparticles in aqueous solution with different concentration of DNA. (Where C1, C2, C3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.7 Photoluminescence spectra of the silver nanoparticles stabilised by DNA excited at 250 nm (c1, c2, c3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.8 Photoluminescence spectra of the silver nanoparticles stabilised by DNA excited at 350 nm (c1, c2, c3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.9 Photoluminescence spectra of the silver nanoparticles stabilised by DNA excited at 420 nm (c1, c2, c3 represents 0.05 wt%, 0.1 wt%, 0.15 wt% of DNA respectively)

4.10 Photoluminescence spectra of the silver nanoparticles stabilised by DNA (0.15 wt%) excited at different wavelength

5.1 Absorption spectra of silver nanoparticles in aqueous solution of BSA (where c1, c2, c3 represents BSA concentration 0.05, 0.1, 0.15 wt% respectively)

5.2 SEM image of silver nanoparticles in BSA template.

5.3 Photoluminescence from silver nanoparticles in BSA template

5.4 Photoluminescence from aqueous solution of BSA

5.5 Open aperture Z-scan curve at 175 MW/cm² of (solid line shows theoretical fit)

5.6 Optical limiting performance of silver nanoparticles in aqueous solution BSA

5.7 Experimental result for closed aperture Z-scan of silver nanoparticles in aqueous solution of BSA.

6.1 Absorption spectra of CdS nanoparticles at different concentration of DNA

6.2 Absorption spectra of CdS nanoparticles at different concentration of BSA.
6.3 Absorption spectra of CdS nano particles without adding biopolymers DNA and BSA

6.4 The \((\alpha h \nu)^2\) vs \(h \nu\) plot of CdS nanoparticles in DNA template

6.5 XRD pattern of CdS nanoparticles in DNA matrix

6.6 XRD pattern of CdS nanoparticles in BSA matrix

6.7 PL spectrum of DNA capped CdS nanoparticles (Where C1, C2, C3, C4 represents DNA concentrations 0.06, 0.128, 0.16.0.2 wt% respectively)

6.8 PL spectrum of BSA capped CdS nanoparticles (Where C1, C2, C3, C4 represents BSA concentrations 0.06, 0.128, 0.16. 0.2 wt% respectively)

6.9 Normalized fluorescence spectra of DNA capped CdS nanoparticles as a function of excitation wavelength.

6.10 Normalized fluorescence spectra of BSA capped CdS nanoparticles as a function of excitation wavelength

7.1 Aerial bacterial colony formed on dye doped nutrient agar medium

7.2 Experimental setup to study the growth kinetics of bacterial colony by using Laser Induced Fluorescence technique

7.3 Fluorescence spectra of bacterial colony marked by Rhodamine B showing Quenching Effect. (a,b,c represents fluorescence spectra corresponding 4th, 5th, 6th day)

7.4 Radial growth of Bacterial Colony Vs Time

7.5 Area of the Bacterial Colony Vs Time

7.6 Microbial growth curve in a closed system

7.7 Peak fluorescence intensity vs time plot of growth of growing bacterial colony

xix