

# Contents

<b>1 Preliminaries</b>	<b>5</b>
1.1 Cousin complex . . . . .	5
1.2 Gorenstein modules . . . . .	10
1.3 Balanced big Cohen–Macaulay modules . . . . .	14
1.4 Gorenstein injective, projective and flat modules . . . . .	18
1.4.1 Gorenstein injective modules . . . . .	18
1.4.2 Gorenstein projective modules . . . . .	23
1.4.3 Gorenstein flat modules . . . . .	25
1.4.4 Gorenstein dimensions . . . . .	27
<b>2 G–Gorenstein modules</b>	<b>31</b>
2.1 Definition and Characterizations . . . . .	31
2.2 Existence and applications . . . . .	43
<b>3 Cousin complex and Top local cohomology module</b>	<b>52</b>
3.1 Flat dimension . . . . .	52
3.2 Torsion depth . . . . .	57
3.3 Co–dualizing module . . . . .	61
<b>4 Balanced big Cohen–Macaulay modules</b>	<b>65</b>
4.1 Gorenstein injective resolution . . . . .	65
4.2 $\Omega$ –Gorenstein injective resolution . . . . .	70