

Table of contents

<i>a. Abstract</i>	<i>i-iii</i>
<i>b. Declaration</i>	<i>iv</i>
<i>c. Certificate</i>	<i>v</i>
<i>d. Acknowledgements</i>	<i>vii-viii</i>
<i>e. Table of contents</i>	<i>ix-xi</i>
<i>f. List of tables</i>	<i>xii</i>
<i>g. List of figures</i>	<i>xiii-xvi</i>
<i>h. List of abbreviations</i>	<i>xvii-xviii</i>

CHAPTER-1

An overview of astrophysical complex fluids	[1-16]
<i>Abstract</i>	<i>1</i>
1.1 Introduction	1-3
1.2 Waves in dusty plasmas	3-6
1.3 Dust molecular clouds and star formation	6-10
1.4 Motivations	11
1.5 Objectives	11-12
1.6 Summary	12
<i>References</i>	<i>12-16</i>

CHAPTER-2

Study of linear stability dynamics in complex viscoelastic astrofluids	[17-34]
<i>Abstract</i>	<i>17</i>
2.1 Introduction	17-18
2.2 Physical model and formalism	18-24
2.3 Results and discussions	24-30
2.4 Conclusions	31-32
<i>References</i>	<i>32-34</i>

CHAPTER-3

Investigation of nonlinear fluctuation dynamics in complex viscoelastic astrofluids [35-56]

<i>Abstract</i>	35
3.1 Introduction	35-36
3.2 Physical model and formalism	36-42
3.3 Results and discussions	42-51
3.4 Conclusions	51-52
<i>References</i>	52-54
<i>Appendix-3.A</i>	55-56

CHAPTER-4

A generalized magnetohydrodynamic model formalism of gravitational instability in spherical astroclouds [57-79]

<i>Abstract</i>	57
4.1 Introduction	57-59
4.2 Physical model and formalism	59-65
4.3 Results and discussions	65-70
4.4 Conclusions	70-71
<i>References</i>	71-75
<i>Appendix-4.A</i>	76-79

CHAPTER-5

Stability of magnetized complex astrofluids with atypical dust-fugacity effects [80-112]

<i>Abstract</i>	80
5.1 Introduction	80-83
5.2 Physical model and formalism	83-93
5.3 Results and discussions	94-104
5.4 Conclusions	104-105
<i>References</i>	106-110
<i>Appendix-5.A</i>	111-112

CHAPTER-6

A hybrid GNA instability mode in neutron star interiors [113-137]

Abstract 113

6.1 Introduction 113-116

6.2 Physical model and formalism 116-124

6.3 Results and discussions 124-132

6.4 Conclusions 132-133

References 133-137

CHAPTER-7

Conclusions and future prospects [138-140]

LIST OF PUBLICATIONS 141