

LIST OF TABLES

TABLE NO.	DETAILS	PAGE NO.
2.1	Stratigraphical Sequence of the Gandhar oilfield	16
3.1	Chemical properties of crude oil of Gandhar oilfield	61
3.2	Physical properties of Gandhar crude oils	63
3.3	Optical rotation properties of crude oil of Gandhar oilfield	65
3.4	Thermal properties of crude oil of Gandhar oilfield	66
3.5	Gas chromatogram data of Gandhar oils	69
5.1	Sequence of search and exploration work	114
6.1	Status of water quality at different locations in Gandhar oilfield and surrounding area	165
6.2	Air contaminants	171
6.3	Air pollutants and its impact on health	171
6.4	Status of air pollution in Gandhar oilfield, Ankleshwar project	174
6.5	Permissible exposure of continuous noise level	177
6.6	Maximum noise level suggested by central pollution control board (CPCB), 1996 of India	178
7.1	Chemical composition of organic material and petroleum	186
7.2	Trend of various reactions on compositions of various type of Materials	187
7.3	Effect of temperature on specific gravity and API gravity	189
7.4	Pristane / Phytane ratio as indicators of depositional environment	191

LIST OF ILLUSTRATIONS

FIGURE NO.	DETAILS	PAGE NO.
1	Location Map of Gandhar oilfield	02
2.1	Map of Ankleshwar project, Cambay basin show in oil and gas field	10
2.2	Tectonic map of Cambay basin in relation to tectonic setting of western India showing saurashtra, kuchchh and Bombay basins	11
2.3	Generalized stratigraphy of Cambay basin	15
2.4A	Regional tectonic framework of the western continental margin	28
2.4B	Map of Gujarat state showing major tectonic movements during Quaternary	29
2.5	Paleogeographic map showing depositional environments	30
3.1	A cross section of a domal trap showing multiple producing Zones and production from fractured basement rock	44
3.2	A cross section of an asymmetrical anticline showing the crest migrating with depth	44
3.3	Cross section of a structure that has been divided into separate producing compartment by a fault	45
3.4	A bald headed anticline forms	45
3.5	Cross section of a trap showing the spill point and closure	45
3.6	Dip-slip fault traps	46
3.7	A tilted fault block trap forms	46
3.8	A series of cross section showing the formation of drag folds by fault movement	47
3.9	A west to east cross section through the over thrust belt showing the thrust faults and drag folds	47
3.10	Cross section showing a buried salt layer covered with compacting sediments	48
3.11	Cross section showing the formation of a salt dome as buoyant,	

	rising salt pierces the overlying sediments	49
3.12	Salt dome traps	49
3.13	An angular unconformity petroleum trap showing reservoir rock terminated under the unconformity surface and overlain by seal	50
3.14	Buttress sand reservoirs located directly above an angular Unconformity	51
3.15	The formation of Buttress sands by beach sand deposition of rising seas covering an erosional surface	51
3.16	Map view of the subsurface reef that may forms the reservoir	51
3.17	Cross section of a pinnacle reef	52
3.18	A shoestring sandstone trap	52
3.19	Sandstone pinch-out or wedge-out traps on a coastal Plain	53
3.20	Diagrammatic sketches showing characteristic combination Traps	53
3.21	Magnified view of sandstone showing the pore throat, the most difficult area for the oil to pass through	56
3.22	A comparison of coarse grained sediments such as sandstone with large pores and pore throats and high permeabilities and fine-grained sediments such as shale with small pores and pore throats and little or no permeability	57
3.23	A comparison of porosity and permeability of typical shales, sandstone and coarse sandstones	57
3.24	magnified view of a sandstone oil reservoir rock showing three sand grains and oil and water sharing the pore space	58
3.25	Schematic diagram of a gas chromatograph	67
3.26	Gas Chromatograph plot of oil of well no. C	70
3.27	Gas Chromatograph plot of oil of well no. D	71
3.28	Gas Chromatograph plot of oil of well no. I	72
3.29	Gas Chromatograph plot of oil of well no. J	73
4.1	Borehole log of well no. A of Gandhar oilfield	77
4.2	Borehole log of well no. B of Gandhar oilfield	80

4.3	Borehole log of well no. C of Gandhar oilfield	83
4.4	Borehole log of well no. D of Gandhar oilfield	86
4.5	Borehole log of well no. E of Gandhar oilfield	89
4.6	Borehole log of well no. F of Gandhar oilfield	92
4.7	Borehole log of well no. G of Gandhar oilfield	96
4.8	Borehole log of well no. H of Gandhar oilfield	99
4.9	Borehole log of well no. I of Gandhar oilfield	102
4.10	Borehole log of well no. J of Gandhar oilfield	105
4.11	Borehole log of well no. K of Gandhar oilfield	108
4.12	Borehole log of well no. L of Gandhar oilfield	111
5.1	Flow-Chart of exploration – exploitation system	115
5.2	Drilling rig and its Components	126
5.3	Mudflow system	129
5.4	A Drill stem test	133
5.5	Casing in a well	134
5.6	The casing program in a well, including string of surface, Intermediate and production casing	134
5.7	Telescopic casing system of oil-well	134
5.8A	Centraliser	135
5.8B	Scratcher	135
5.9	open hole completion	137
5.10A	Cased hole completion (with packer)	137
5.10B	Cased hole completion (without packer)	137
5.11A	Multiple completion (single completion)	138
5.11B	Multiple completion (dual completion)	138
5.12	Perforating operation	138
5.13	A surface pumping unit	139
5.14	Fishing for junk in the well	141
5.15	Lost circulation caused by drilling mud flowing into a porous and permeable rock layer without building up a filter cake	142

5.16	A christmas tree	144
5.17	An artificial lift pump (Sucker rod pump)	145
5.18	Group gathering system	146
5.19	Central tank form	146
5.20a	Flow chart of central tank form of gas handling	147
5.20b	Flow chart of central tank form of oil handling	147
5.21	Oil and gas separator	148
5.22	Water and gas injection and production of oil	150
5.23	Polymer flooding	150
5.24	Surfactant flooding	151
5.25	Alkaline flooding	152
5.26	Wet in-situ combustion	154
6.1	Flaring in a oil refinery	161
6.2	Oil spills in a studied Gandhar oilfield wellsite	162
7.1	Correlation of oil wells	195
7.2	Structural correlation of Gandhar and Nada wells showing pinch-out of sands towards Nada field	196
7.3	Bulbula tank showing emulsion of oil and gas	198