1.1 GENERAL:

Groundwater is one of the most valuable natural resources, supports human health, economic development, ecological diversity and largest available source of fresh water lays underground. Due to its several inherent qualities (e.g. consistent temperature, widespread and continuous availability, excellent natural quality, limited vulnerability, low development cost and drought reliability), increase in the agricultural, industrial and domestic activities in recent years has increased the demand for good quality water to meet the growing needs and it has become an important and dependable source of water supplies in all climatic regions including both urban and rural areas of developed and developing countries (Todd and Mays, 2005). Of the 37 Mkm$^3$ of fresh water estimated to be present on the earth, about 22% exists as groundwater, which constitutes about 97% of all liquid freshwater potentially available for human use (Foster, 1998). In India, more than 90% of the rural and nearly 30% of the urban population depends on groundwater for meeting their drinking and domestic requirements (Reddy et al., 1996). Thus, groundwater is emerging as a formidable poverty reduction tool in developing countries and can be delivered to poor communities for more cheaply, quickly and easily than the conventional canal irrigation water (IWMI, 2001). An approach for groundwater investigation is very costly, time-consuming and requires skilled manpower (Sander et al., 1996). As Remote Sensors cannot detect groundwater directly, the presence of groundwater is inferred from different surface features derived from satellite imagery such as geology, lineament, landforms, soils, land use/land cover,
surface water bodies, drainage, slope, which acts as indicators of groundwater existence (Todd, 1980; Jha and Peiffer, 2006).

Exploration and utilization of groundwater especially in hard rock terrains, requires thorough understanding of geology, geomorphology and lineament of an area, which are directly or indirectly controlled the terrain characteristics (Ravindran and Jayaram, 1997; pradeep, 1998, Kumar et al, 1999).

Groundwater potential zones were delineated using Remote Sensing and Geographical information system (GIS) techniques drawing from a database that includes climate, geology, lithology, geomorphology, drainage pattern, lineament, soil and topographic slope and satellite data.

Delineation of groundwater potential zones and groundwater modeling involve a large volume of multidisciplinary data, an integrated application of GIS techniques has become a valuable tool. In the past, several researchers (from India and abroad) have used GIS techniques for the delineation of groundwater potential zones with successful results. These are majority of which focus on hard-rock terrains. Groundwater is mostly preferred to meet this growing demand because of its lower level of contamination and wider distribution. Groundwater studies have become crucial not only for targeting groundwater potential zone, but also for monitoring and conserving this vital resource. Groundwater exploration operation is essentially a hydrogeology and geophysical inference operation and is dependent on the correct interpretation of the hydrological indicators and evidence.

Remote Sensing is an excellent tool for hydrologists and geologists in understanding the “perplexing” problems of groundwater exploration. In recent years, Remote Sensing data has been widely used in locating groundwater potential zones. Remote Sensing data is not only cost effective, reliable and timely but also meets the
essential requirements of data in the Geographical Information System (GIS) domain, which are “current, sufficiently accurate, comprehensive and available to a uniform standard”. Integration of the information on the controlling parameters is best achieved through GIS which is an effective tool for storage, management and retrieval of spatial and non-spatial data as well as for integration and analysis of this information for meaningful solutions. The technique of integration of Remote Sensing and GIS has proved to be extremely useful for groundwater studies, few research works being carried out in the regard of groundwater potential zones of Chamarajanagar taluk and could be clarified through collection of available literature’s of the research works.

1.2 SCOPE AND OBJECTIVES OF THE RESEARCH WORK

The Major objectives of the research work are:

1. To evaluate the Geological and Hydrogeomorphological conditions of the study area by using Remote Sensing and GIS data bases.

2. To delineate the land use/land cover categories using satellite imageries.

3. To analyse the chemistry of groundwater and its quality to decipher the suitability for various purposes.

4. To determine the thickness of weathered zone and fractured aquifer system based on resistivity data.

1.2.1 Methodology:

1. Detailed Morphometric analysis of various sub-basins and preparation of drainage maps.

2. Compilation of Geological and Soil maps
3. Analysis of Meteorological data and preparation of average annual rainfall of various seasons.

4. Preparation of slope, hydrogeomorphological, groundwater potential and lineament maps and Categorisation of Slope based on IMSD tech. guideline.

5. Preparation of Land use/Land cover, Satellite maps.

6. Collection of Groundwater samples from existing borewells and analysis of groundwater to know the variations of Hydrogeochemical parameters like TDS, Electrical Conductance, Total hardness, pH, Ca, Mg, Na,K, Fe, HCO₃, NO₃, SO₄.

7. A Field resistivity survey has been carried out using Vertical Electrical Sounding (VES) to findout the fracture zones and delineating groundwater potential zones of the area.

8. Integration of thematic maps like drainage, soil, geology, hydrogeomorphic, lineament and Resistivity data has to be done to identify the delineating groundwater potential zones of the area.

9. The summary and conclusion

The result of the investigations and identify the delineating groundwater potential zones obtained on the geological setting, drainage pattern, morphometric analysis, and thematic maps like hydrogeomorphic map, landuse/landcover maps, soils, lineaments maps, slope, geology, thickness of weathered zones, aquifer resistivity, hydrometeorology and hydrogeochemistry, the direction of flow of groundwater quality like the presence of total hardness, fluoride, iron and bacteria etc.
1.3 BRIEF RESUME OF PREVIOUS WORKS IN THE STUDY AREA:

Not much work has been done in this area regarding delineating groundwater potential zones. Department of Mines and Geology, Government of Karnataka. Has published the Groundwater bulletin in the year of 2009-10.

1.4 GENERAL FEATURES OF THE CHAMARAJANAGAR TALUK:

Chamarajanagar district is located in the south end of the Karnataka state, Chamarajanagar is one of the taluk which is located in the southern part of the district and southern border of the taluk is links with Tamilnadu State, to the west is Gundalpet and Nanjangud taluk and north is T.Narasipur taluk to the east is Yelandur taluk. This taluk comprises of 5 Hobali’s namely Chamarajanagara (kasaba), Haradanahalli, Harve, Santhemaralli, Chandakavadi and its comprises of 42 Gramapanchayath (GP). The main river of this Taluk is “Suvarnavathi”. It is also knows as “Honnu Holy”. It flows via Ramasamudra and Alur towards Yelandur. The Suvarnavathi is a tributary of river Cauvery is also known as “Chikka Holay”, it is only water resource for the residents of Chamarajanagar Town. A dam was constructed at Attigulipura for this River and it measures 1158 mts long. In 1971 it is being used for the purpose of irrigation. In the down stream of the river a small dam was constructed. Quarrying of hard granite is a major activity in the taluk, which is used for production of decorative polished slabs, civil construction work and also used as a road material.

1.4.1 Location and Extent of the Study Area:

Chamarajanagar taluk, Chamarajanagar district of Karnataka comes under the semi-arid region. It lies between 11°40’ 00”N-12°15’ 00”N Longitude and 76°40’00” E-77°15’00” E Latitude with geographical area extent of 1235.9 sq. kms covering
190 villages coming under the survey of India (SOI) Toposheet nos.57D/12, 57D/16, 57H/4, 58A/9, 58A/13, 58A/14, 58E/1, 58E/2, 58E/5, on a scale of 1:50,000. The study area fall in southern dry–agro-climatic zone.

1.4.2 Accessibility of the Study Area:

The study area is accessible by good motorable road and is very well connected by Mysore to Chamarajanagar broad gauge southern railway line length of 60 Km (From Bangalore 157 KM) which is observed in location of the Study Area (Map 1.1).

1.4.3 Climate:

The climate of the study area is quite moderate whole the year with a fairly hot summer and cold winter. March to May are the summer months/Season, June to September are monsoon months/Season, October to December are post monsoon months/Season as well as January to February are winter months/season. The mean maximum temperature is 34°C and the mean minimum temperature is 16.4°C. The annual rainfall is 696 mm. (Source: As per Statistical department data).

1.4.4 Physiography:

Based on the Physiography of Karnataka state has been classified into four plateaus. They are Northern Karnataka Plateau, Central Karnataka Plateau, Southern Karnataka Plateau, and Karnataka Coastal Region. The Physiography of the study area has classified as Southern Karnataka plateau, partly maidan, plain, undulating and mountainous region. The average elevation of the study area is 656 m above Mean Sea Level (AMSL).
1.4.5 Forest and Vegetation:

The forest vegetation is tropical dry deciduous forest and its merges into thorn forest whenever the annual rain fall drops below 696mm. Some evergreen and moist deciduous forests occupy a small area in southern part of the state. The scrub jungle towards the eastern limits of the study consists of stunted trees, interspersed with bushes and open grassy patches. The study area has covered by forest about 22% of the district. The priniciple species in the forest are Teak, Honne, Rosewood, Neem, Mango, Tamarind, Eucalyptus and Sandalwood.

1.4.6. ORDER OF PRESENTATIONS:

The result of the present investigations have been presented in the form of the Thesis addressed into 8 chapters as follows.

Chapter-1 is concerned with Introduction and it explains the reason for the choice of this problem and about the general features, Locality, Accessibility and Physiography of the study area.

Chapter-2 Embodies the Geology and Soils Structure of the Dharwar Craton as well as Geology and Soils of the study area. The study area is a hard rock terrain consisting of Peninsular Gneisses, Ultra-mafics hornblende schist and is intruded by Dolerite dykes.

Chapter-3: Deals with the hydrological investigations using Hydrometeorological parameters. The data pertaining to various Hydrometeorological parameters viz., Temperature, Relative humidity, Sunshine, Solar radiation, Wind speed and Rainfall are presented. The monthly averages, spatial distribution of Rainfall data of the study area are interpreted.
Chapter-4 Deals with Drainage system and Morphometric analysis based on Linear and Aerial aspects. The various Morphometric parameters like stream order and its number, stream length, mean stream length, stream length ratio and bifurcation ratio under linear aspects, basin area, basin perimeter, drainage density, stream frequency, constant channel maintenance, length of the overland flow, texture ratio, form factor, circularity ratio and elongation ratio under aerial aspects have been calculated and interpreted.

Chapter-5 Describes Hydrogeochemistry. The Groundwater samples of different bore wells have been collected and analysed for various hydrogeochemical parameters viz., TDS, Electrical conductance, TH and pH along with ions like Ca, Mg, Na, K, Fe, HCO₃, Cl, NO₃ and SO₄. The hydrogeochemical data is presented, plotted on to WHO and ISI Standard.

Chapter-6 Discuss with Hydrogeophysics, delineate the thickness of weathered zone and thickness of the fractured aquifer system and also lithology based on the resistivity data.

Chapter-7 Deals with the Remote Sensing and GIS.

Chapter-8 Discusses with the integrated approach through Remote Sensing and GIS.

Chapter-9: deals with Summary and Conclusions.

The summary of the present work along with important conclusion arrived and presented.