IV SUMMARY AND CONCLUSION
IV SUMMARRY AND CONCLUSION

4.1. SUMMARY:-

CHAPTER - I

Introduction:-

The physical properties of substance are those which could study and determine without causing any chemical change in it. The basic physical properties of liquid are density, viscosity, solubility, Vapor pressure, surface Tension, Refraction etc. The flow is characteristic property of liquid.

Viscosity is a physical property of all liquids. Viscosity is a measure of the internal friction to flow. Viscosity is affected by temperature and pressure. As temperature and pressure of liquid and gases changes viscosity also changes.

Viscosity is two types, Absolute or dynamic viscosity and Kinematic viscosity.

Absolute viscosity measure the tangential force per unit area between layers of liquids which results. In case of more viscous the fluid, the larger is velocity change between the layer of the liquid because the larger the area of contact between layers of liquids which results increase in tangential force.

Thus viscosity of fluid is defined as the measure of how resistive the fluid is to flow the flow is characteristics property of liquid which dependent on the viscosity having two types Newtonian liquids and Non-Newtonian liquids. The flow is characteristics property of liquid which dependent on the viscosity having two types Newtonian liquids and Non-Newtonian liquids.

Newtonian liquids:- Those liquids in which viscosity remains constant and not depend on the shear stress.

Non-Newtonian liquids:- Those liquids in which viscosity based on the applied shear force and does not remains constant.
This information and other understanding is useful to know about different types of interaction among different molecules. Related to viscosity, a very large number of theoretical, experimental, and analytic investigations is carried out.

All liquids possess a characteristic property that is flowing under an applied force, these forces of their own weight. When a liquid flows through a tube, the liquid layer in contact with the wall of the tube is stationary whereas the center layer has the minimum velocity, and the intermediate layers have gradation of velocities.

Similarly, when liquid flows over a glass plate, the layer which is in contact with the glass plate is stationary. While the velocity of the different layer increases with increasing distance from the surface, the layer which has high velocity with the free surface of the liquid. On the basis of this relative motion of each layer, frictional force is generated, and it is being dragged in the backward direction, and work has to be done to maintain the flow. Thus, internal friction which resists the relative motion of the liquid is termed as viscosity.

There is many theory of viscosity, but the important theory given by Newton. According to Newton's theory when liquid flows, the layers of liquid move at different velocities, and liquid viscosity arises due to shear stress between moving layers that oppose an applied force.

These Newton stated that the following relations exist between shear stress and velocity gradient.

\[ \tau \alpha \frac{du}{dy} \]

\[ \tau = \nu \frac{du}{dy} \]

Where \( \tau \) is shear stress, \( \nu \) is coefficient of viscosity, and \( \frac{du}{dy} \) is velocity gradient.

Many fluids show such type of relation termed as Newtonian fluid when non-Newtonian fluid has a complicated relationship between shear stress and velocity gradient.
Factors affecting on the viscosity of liquids

1. Molecular weight increase viscosity increase that related to density. Molecular weight directly proportional to density as the density increase distance between liquid molecule decreases. That result cohesive forces between molecules increase and viscosity of liquid increase.

2. Branched chain compounds have higher viscosity than strain chain compounds in branched chain compound cohesive forces between molecules increase and viscosity of liquid increase.

3. The polar compounds are more viscosity than non polar compounds in polar compounds cohesive force attributed to the presence of different type of intermolecular forces which result increase in viscosity.

4. The viscosity of pure solvent is lower than viscosity of solution. Added solute increases the viscosity of solvent.

5. Temperature increase viscosity decrease as temperature increases kinetic energy of molecule increase, cohesive forces decrease and molecular movement increase which result decrease in viscosity.

6. Pressure increases viscosity increase at high pressure on liquid cohesive forces increase and movement of molecule decrease which result of that viscosity increase.

In this study we study the effect of polar and non-polar solvent at different temperature on viscosity of aliphatic and aromatic ketones.

These polar and non-polar solvent Liquid mixtures with Aliphatic and Aromatic ketones causes different type of Intermolecular Interaction which result of change in viscosity of pure compounds of Aliphatic and Aromatic ketones is useful for manufacturing of product to detecting pour ability and pump ability.

In general, any atom consists of positively charged centrally situated nucleus and negatively charged electronic charge cloud at some distance from the nucleus. An atom is always electrically neutral as positive and negative charges are always equal. When a molecule is formed by the interaction between two or more atoms, then there is a centre of positive charge
due to nuclei of reaction atoms and also a centre of negative charges due to electronic charge clouds of the atoms. If the centers of positive and negative charges coincide at one point then the molecule is said to be non-polar. In case of polar molecules, the centers of positive and negative charges do not coincide. They are away from one another by a distance say 1 cm. Non-polar molecules possess zero dipole moment while polar molecules possess non-zero dipole moment. If q esu is the electronic charge and 1 cm is the distance of separation of charges then the dipole moment \( u \) is defined as the product of charge and distance of separation of charges. Thus,

\[
\mu = q \times 1 \text{ esu cm.}
\]

A solvent having partial positive and negative charges separated by distance having two poles i.e. dipole known as polar solvent.

The extent of polar character depend upon electronegative difference of combining atoms greater is electronegative difference greater is polar character of solvent. The polarity of solvents can be conveniently measured in terms of dipole moment.

A solvent of pure covalent bond having no any charges separation between atoms of molecules considered as Non-polar solvent them having zero dipole moment. There are three main types of intermolecular interactions are possible.

**Dipole-dipole interaction:**

These Interactions observed between two polar molecules having permanent dipole moment. When two polar molecules approach each other in such way that oppositely charged end come closer to one another to form dipole-dipole Interaction. The dipole-dipole Interaction strength based upon dipole moment of Interacting molecules. During such type of Interaction electrostatic force of attraction developed between Liquid mixtures which results change in viscosity of binary liquid mixture. As higher the dipole moment stronger is the intermolecular interaction cause increase in viscosity of liquid mixtures.

Knowledge of viscosity is important in engineering designing, new Technology process. Product dimension, petroleum industries, oil industries, metallurgical manufacturing process such as
casting and rolling etc. Calculating forces and momentum on aircraft, predicting weather pattern, in weapon detonation, optical fiber, soap industries, plastic industries etc.

The measurement of viscosity is of considerable importance in both industrial production and fundamental science. Viscosity is the quantity that determines the force to be overcome when fluids are used in pipelines or bearing and it controls the flow of liquid in such processes. In other applications, the measurement of viscosity affords a convenient means of checking the constancy of product. Viscosity measurement has also proved to be a valuable tool for physical chemistry science.\textsuperscript{5-8}

**VISCOSITIES OF SOME ALIPHATIC AND AROMATIC KETONES AND THEIR BINARY MIXTURES WITH POLAR AND NON-POLAR SOLVENTS**

This title is taken for study because knowledge of viscosity is important in engineering designing, new technology process. Product dimension, petroleum industries, oil industries, metallurgical manufacturing process such as casting and rolling etc. Calculating forces and momentum on aircraft, predicting weather pattern, in weapon detonation, optical fiber, soap industries, plastic industries etc.

The measurement of viscosity is of considerable importance in both industrial production and fundamental science. Viscosity is the quantity that determines the force to be overcome when fluids are used in pipelines or bearing and it controls the flow of liquid in such processes. In other applications, the measurement of viscosity affords a convenient means of checking the constancy of product. Viscosity measurement has also proved to be a valuable tool for physical chemistry science.\textsuperscript{5-8}
Conclusion:

To study of physical properties like viscosities, densities of aliphatic and aromatic ketones and their binary mixture with polar and non-polar solvents are receiving attention in chemistry because of their importance in industrial processes. These physical properties involve challenges of interpreting the excess quantities as a means of understanding the nature of intermolecular interaction among the binary mixture.

Densities of liquid mixture and related volumetric properties such as molar excess volume are required for theoretical calculation as well as applications. The sign and value of molar excess volume gives strength of interaction in binary mixture of ketones with polar and non-polar solvents. Larger the positive value of molar excess volume indicates weak interaction and dissociation between binary mixtures. Whereas larger negative value of molar excess volume indicates strong interaction and intermolecular association between binary mixtures are believed to be present. Viscosity of binary mixture gives valuable formation about nature liquid-liquid molecules interaction. Now a day’s computer simulation method of dynamics gives information of molecular theory of transfer properties in liquids and get knowledge of molecular motion and interaction patterns in system showing dispersion and specific interaction in liquid-liquid mixture of both non-hydrogen bonding and hydrogen bonding solvent.

In the present work, binary mixtures of ketones with polar & non polar solvents and thermodynamic properties like densities and viscosities of will be measured over a complete range of composition at given three different temperatures From these values of densities and viscosities, molar excess volume $V^E$, deviation in viscosity $\Delta \eta$ will be calculated.

The observed deviation in viscosity may be showing different type of specific interactions like hydrogen bond and dipole-dipole interactions.
CHAPTER - II

Introduction:-

In recent year large amount of work has been done in the investigation of solution chemistry. To study the thermodynamic property of binary liquid mixture much work has been done of viscosities, densities, molar excess volume, deviation in viscosity of binary liquid mixture of ketones and solvents. But it is beyond the scope of this thesis to gives an entire coverage of published literature. In view of this we have observed the present review only on the solvent used in present work. However in present thesis, emphasis will be given on the measurement of physical properties viz. density, viscosity of different binary liquid mixture of aliphatic and aromatic ketones with polar and non-polar solvents at different temperature. Using this data the mixing quantities have been evaluated to investigate their effect in terms of the binary interactions.

D. S. Vishwantath, T. K. Ghoseh and et.al.\textsuperscript{2} in the book of viscosity of liquid studied theory estimation experimental of viscosity and data of viscosity are collected and evaluated from literature it is one kind of field to recognized that the design engineers scientists and technologists to better understands theories, experimental procedure and operational aspects of viscometers, These available data are necessary for design of equipment and other calculations. These data must be interpolated or extrapolated using the existing literature data and using appropriate correlation or models. This type of work more importance as the amount of experimental works in collection.

G. Reddy, V. Swathi, chowary and et.al.\textsuperscript{4} studied liquid mixture of butan-2-one with benzene. Density and viscosity measured experimentally are used for calculate parameters like molar excess volume, deviation in viscosity, at different temperature. The value is fitted to MC Allister model and Krishnan and laddha model. Comparison has been interaction existing between the components was also discussed

T. Savitha Jyostna and N. Stayanarayana.\textsuperscript{8} studied basic physical properties of two liquid mixture of acetonitrile with aromatic ketones such as propiophenone, acetophenone, p-methylacetophenone, p-chloroacetophenone at 308.15K. From the experimental data The excess parameters found to be calculated  molar excess volume and deviation in viscosities were negative for all two liquid mixtures concluded that there is between acetonitrile and aromatic
ketone have strong dipole-dipole interaction which result in decrease of volume there order of molecular interaction of aromatic ketone are CI-Aph > Me-Aph > P-ph > Aph. throughout composition and temperature of mixture have been studied in terms of molecular interactions between unlike molecules.

V. Madhurima.\textsuperscript{68} studied semi-empirical conformational analysis of methanol with acetone, butan-2-one, 3-pentanone; cyclohexanone analysis is done using PM3 semi-empirical Hamiltonian. Whereas dipole moment are determined using dielectric relaxation at microwave X-bond frequency from these experimental data variation of hydrogen bond angle have been studied result of conformational analysis compared with experimental data.

S. S. J Srinivas and B. Tulasi koteswariba.\textsuperscript{70} at temperature 298.15 and 308.15K were measured two liquid mixtures ultrasonic velocities, viscosities and densities of 2-methyl-2-propyle alcohol with acetophenone, methyl isobutyl ketone from these experimental data acoustical parameters free volume, free length and adiabatic compressibility are calculated. This result will conclude intermolecular association or dissociation of repulsion and orientations of solvent molecules around the liquid molecules. They also explain effect of temperature on molecular interactions which become weaker with increase in temperature.

Iabal and et.al.\textsuperscript{119} worked on partial molar excess volume of drugs in aqueous and ethyl alcohol solvents. The molar volume data of the drug studied showed solution behavior consistent with the general rules governing the behavior of electrolytic, non-polar and amphiphilic nature of solutes in water. The calculated data of ionic compressibility’s showed that correlation exists between compressibility’s size of ion, and structural complexity. The difference in volume is due to hydrophobicity of solutes. The hydrophobicity of these compounds used to study of drug action.

Attwood and et.al.\textsuperscript{120} studied the different physicals properties of phenothiazine and chlorpromazine drugs in water at different temperature. As the temperature increase there is nearly increase in molar volume and compressibility of chlorpromazine in micelles form. This work was very useful to known about role of bimolecules in thermodynamic behavior of biochemical processes in living cells. The trends in values of apparent molal volume and modal compressibility were attributed to significant Interaction between the two bimolecules.
J. S. Rowlinson. Worked on thermodynamic properties varies liquid mixture from experimental data, Excess parameters like molar excess volume, viscosity deviation was calculated. In terms of liquid theory worked towards reformulation of average rules for Van der Waals mixtures and calculated values are found in much better agreement with the experiment from their approach even when one fluid-theory is applied. they attempted first to evaluate the thermodynamic functions for a mixture of solution in terms of intermolecular energy parameter developed a fluid versions of the cell model, they gave a new approach with his theory of the attractive part of intermolecular potential is treated as perturbation on hard sphere potential. A more successful approach is due to Flory who also makes use of certain features of cell theory and assumes an empirical equation for the dependence of energy on volume.
**Hypothesis:**

This study is significant because it is applied aspect. A brief account on observed fact concerning the effect of temperature, molecular weight and density on viscosities and of selected ketones and how these facts may be interpreted will be presented through his work. We may also come to known the effect of various substituents on the viscosities of ketones. The viscosity data correlated with thermodynamic parameter. This correlation will be observed through the experimental facts. The objective understanding; The Viscosities of ketones will be useful through which other characteristics of liquid may be observed. The significance of this work is the viscosity is the fundamental property that can be used in conjunction with other properties to characterize pure ketones.

The measurement of viscosities ketones can be functioned for the area of quality control, where raw materials must be consistent. For this purpose, product consistency and quality will be measured by flow behavior indirectly.

Many manufactures now for development, and process control programs regard viscometers as main part of their research. Because of that viscosity measurements are, most accurate and most easily able often the quickest way to analyze some of the most important factors which affecting product quality and quantity. Viscosity value have numerous application in UV Curable coating, inks, optical fibers, plastic industries, soap industries, petroleum industries, oil industries and researchers in chemistry, biology and medicine field.

**2.3. Methodology:**

**2.3.1. Density:**

The density $\rho$ of ketones or their liquid mixtures is generally expressed as g.cm$^{-3}$ in CGS or more appropriately as kg.m$^{-3}$ in SI system. It is one of the most useful physical properties and is widely employed in the characterization of material, both single and multi component. It is also a factor in the calculation of many other properties such as molar excess volumes, viscosity, isentropic compressibility, specific acoustic impedance etc. Density of each liquid will be measured at various experimental temperatures.
2.3.2. Density Measurements:

Densities were be measured by pycnometer which having capillary of diameter 0.75 mm and a pycnometer bulb of volume 5 cm³, as shown in figure.2.1

The densities were being measured at various experimental temperatures. The pycnometer filled with double distilled water it is important that air bubble is not enter by means of a hypodermic syringe. The pycnometer hung vertically in a thermostatically controlled water bath, Julabo F-25 MP thermostat (made in Germany), whose temperature maintained constant by circulating water through capable of maintaining constant temperature (± 0.02 K). The pycnometer is to be kept for 30 minutes in thermostatically controlled water bath to achieve the stable expected temperature. The volume (v) of pycnometer will be determined using equation.

\[ v = \frac{m}{\rho} \]

The pycnometer again hung vertically and the temperature of water bath raised up to next experimental temperature. The temperature of pycnometer maintained thermostatically to achieve the stable temperature by waiting for 30 minutes before density measurement. The density for next temperature can be determined by measuring an increase in height of water level from the mark. Following equation used to calculate increased volume \( (V_i) \) of water.

\[ V_i = \pi r^2 h \]

Where \( r \) is radius of capillary and \( h \) is height of increased water level and added into volume \( V \). The density of double distilled water can be calculated keeping mass \( m \) constant using relation,

\[ \rho = \frac{m}{(v + v_i)} \]

The necessary buoyancy correction will be taken in to account for every measurement. Mettler one pan balance used to measurements of masses whose accuracy is of ± 0.01.

2.3.4. Viscosity:
Viscosity may be defined as the force per unit area required for maintaining unit difference of velocity between two parallel layers in the liquid one centimeter apart. The coefficient of viscosity is expressed in dyne sec per square centimeter. Viscosity of each experimental liquid or binary liquid will be measured at various experimental temperatures.

A liquid flowing through the narrow glass tube, velocity of successes layers increase with move away from the surface, but the layer in contact with surface of inner wall of the tube is stationary. While the molecules move from the slower layer to faster layers. There raises friction force or drag between the two layers that giver rise viscosity. Thus viscosity is defined as it is force of friction between two layers of liquid moving post one another with different velocities.

2.3.5. Viscosity Measurements:

The series of Ubbelohde viscometers were used to measurements of Viscosity. The viscometer is provided with digital watch for the automatic flow time measurements. The viscometer is to clamp vertically in a thermostat, to maintaining constant temperature (± 0.02°C) a thermostatically controlled water bath were used. The viscometer is kept for 30 minutes in thermostatically controlled water bath to achieve stable temperature. The experiments of flow time measurements to be performed for all solution for four times at all temperature and average of the results will be taken. Kinetic energy corrections to be taken into account for each the measurements. The accuracy of flow time has to be ± 0.01 sec. By using densities and flow times Dynamic viscosities \( \eta \) at different temperatures were calculated.
Results and discussion

Results:

In this section the excess thermodynamic properties of binary mixture of aliphatic and aromatic ketones with polar and non-polar solvent at three different temperatures are reported up to discussion.

The excess function is used for the measurement molecular interactions between the component of molecules in liquid mixtures and deviation of the original nature of the mixtures. The sign and magnitude of these excess functions are used to find out interaction strength between unlike molecules.

DISCUSSION:

SECTION-I

The physical properties like density $\rho$, viscosity $\eta$ of propan-2-one with methanol, ethanol, benzene and toluene at different temperatures are measured and listed in table 3.1.1 to 3.1.4. The excess thermodynamics properties molar excess volume $V^E$, deviation in viscosity $\eta^E$, viscous flow of excess Gibb’s free energy $\Delta G^E$ of propan-2-one with methanol, ethanol, benzene and Toluene at given three different temperatures are listed in table 3.1.1 to 3.1.4. The sign of excess properties assessing the extent of molecular interaction and the compactness due to molecular arrangement. The change in mole fraction of mixture reasonable qualitative explanation for the behavior of mixture in present study has been suggested.

In present work the negative deviation in viscosity indicate existence of specific as well as structural interaction between polar solvent propan-2-one with non-polar solvents benzene and toluene. The negative deviation indicates that there is dipole-induced dipole type of interaction. In case of propan-2-one with benzene liquid mixture interaction between >C=O group of ketone with delocalized $\pi$ electrons of benzene ring. There also occurrence of charge transfers, as well as different type of weak intermolecular interactions between propan-2-one and benzene. The negative $V^E$ value trends as benzene<Toluene, This indicate in case of liquid mixture of polar solvent propan-2-one with non-polar solvent toluene. Higher the value of deviation in viscosity is due to the introduction of methyl group in aromatic hydrocarbon ring of toluene. Increases
electron density on the molecule and hence there occurs repulsive interaction between electronic charges of $\pi$-electrons of toluene and electronic charge on oxygen atom of propan-2-one charge on oxygen atom of 2-Propanone leading to increase in negative deviation.

There may be intermolecular interaction between propan-2-one and toluene due to hyperconjugation by the presence of methyl group on aromatic ring such type of interaction are weaker interaction.

**SECTION-II**

The physical properties like density $\rho$ viscosity $\eta$ of butan-2-one with methanol, ethanol, benzene and toluene at different temperatures and at atmospheric pressure are measured and listed in table 3.2.1 to 3.2.4 The excess thermodynamics properties molar excess volume $V^E$, deviation in viscosity $\eta^E$, viscous flow of excess Gibb’s free energy $\Delta G^E$ of butan-2-one with methanol, ethanol, benzene and Toluene at different temperatures at atmospheric pressure are measured and listed in table 3.2.1 to 3.2.4 The sign of excess properties assessing the extent of molecular interaction and the compactness due to molecular arrangement. The change in mole fraction of mixture reasonable qualitative explanation for the behavior of mixture in present study has been suggested.

In present work the negative deviation in viscosity indicate existence of specific as well as structural interaction between polar solvent methanol and ethanol with butan-2-one. The negative deviation may be attributed to dipole-induced dipole type of interaction. In case of butan-2-one with non-polar solvents benzene and toluene binary mixture positive $V^E$ it shows interaction between $>\text{C}=$O group of ketone with delocalized $\pi$ electrons of benzene ring. There also occurrence of charge transfers, as well as weak intermolecular interactions between butan-2-one and benzene. The positive $V^E$ value trends as Toluene $<$ benzene, this indicate in case of liquid mixture of polar solvent butan-2-one with non-polar solvent toluene and benzene. Higher the value of deviation in viscosity is due to the introduction of methyl group in aromatic hydrocarbon ring of toluene. Increases electron density on the molecule and hence there occurs repulsive interaction between electronic charges of $\pi$-electrons of toluene, benzene and
There may be intermolecular interaction between butan-2-one and toluene due to hyper conjugation by the presence of methyl group on aromatic ring such type of interaction are weaker interaction.

**SECTION-III**

The physical properties like density $\rho$, viscosity $\eta$, of acetophenone with methanol, ethanol, benzene and toluene at given three different temperatures and at atmospheric pressure are measured and listed in table 3.3.1 to 3.3.4. The excess thermodynamics properties molar excess volume $V^E$, deviation in viscosity $\eta^E$, viscous flow of excess Gibb’s free energy $\Delta G^E$ of acetophenone with methanol, ethanol, benzene and Toluene at given three different temperatures are listed in table 3.3.1 to 3.3.4. The sign of excess properties assessing the extent of molecular interaction and the compactness due to molecular arrangement. The change in mole fraction of mixture reasonable qualitative explanation for the behavior of mixture in present study has been suggested.

In present work the negative deviation in viscosity indicate existence of specific as well as structural interaction between polar solvent methanol and ethanol with acetophenone. The negative deviation was observed that to dipole-induced dipole type of interaction. In case of acetophenone with non-polar solvents benzene and toluene liquid mixture negative $V^E$ it shows interaction between $>\text{C}=\text{O}$ group of ketone with delocalized $\pi$ electrons of benzene ring. There also occurrence of charge transfers, as well as weak intermolecular interactions between acetophenone and benzene. The negative $V^E$ value trends as benzene<Toluene. This indicates in case of liquid mixture of polar solvent acetophenone with non-polar solvent toluene and benzene. Higher the value of deviation in viscosity is due to the introduction of methyl group in aromatic hydrocarbon ring of toluene. Increases electron density on the molecule and hence there occurs repulsive interaction between electronic charges of $\pi$ -electrons of toluene, benzene and electronic charge on oxygen atom of acetophenone leading to increase in negative deviation³⁸.
There may be intermolecular interaction between acetophenone and toluene due to hyper conjugation by the presence of methyl group on aromatic ring such type of interaction are weaker interaction.

SECTION-IV

The physical properties like density $\rho$, viscosity $\eta$ of propiophenone with methanol, ethanol, benzene and toluene at given three different temperatures and at atmospheric pressure are measured and listed in table 3.4.1 to 3.4.4 The excess thermodynamics properties molar excess volume $V^E$, deviation in viscosity $\eta^E$, viscous flow of excess Gibb’s free energy $\Delta G^E$ of propiophenone with methanol, ethanol, benzene and Toluene at given three different temperatures and listed in table 3.4.1. to 3.4.4. The sign of excess properties assessing the extent of molecular interaction and the compactness due to molecular arrangement, the change in mole fraction of mixture reasonable qualitative explanation for the behavior of mixture in present study has been suggested.

In present work the negative deviation in viscosity indicate existence of specific as well as structural interaction between polar solvent methanol and ethanol with propiophenone. The negative deviation indicates May dipole-induced dipole interaction. In case of propiophenone with non-polar solvents benzene and toluene binary mixture negative $V^E$ it shows interaction between $\text{C}=\text{O}$ group of ketone with delocalized $\pi$ electrons of benzene ring. There also occurrence of charge transfers, as well as weak intermolecular interactions between propiophenone and benzene. The negative $V^E$ value trends as benzene $<$ Toluene, This indicates in case of binary mixture of polar solvent propiophenone with non-polar solvent toluene and benzene. Higher the value of deviation in viscosity is due to the introduction of methyl group in aromatic hydrocarbon ring of toluene. Increases electron density on the molecule and hence there occurs repulsive interaction between electronic charges of $\pi$ -electrons of toluene, benzene and electronic charge on oxygen atom of propiophenone leading to increase in negative deviation³⁸.

There may be intermolecular interaction between propiophenone and toluene due to hyper conjugation by the presence of methyl group on aromatic ring such type of interaction are weaker interaction.
4.2 CONCLUSION:-

The aim of present work to study the physicochemical properties of binary liquid mixtures at different temperatures and to collect new experimental data on various properties like densities and viscosities for the over the throughout compositions and, Furthermore the study involved the evaluations of the excess functions and interaction parameters from the experimental data and interpretation of the intermolecular interaction and testing of various existing theoretical models.

Therefore in view of those considerations, the study of liquid –liquid system involving ketones are the primary solvents, was undertaken, in chemical industry knowledge of binary mixture solution is essential for design involving different type, chemical separation and flow of fluid. To study Physico-chemical properties of solvent molecules and its interpretation in terms of solute- solvent interactions, in today there has been renewed interest. Thus, present work was undertaken considering the importance of physicochemical properties in understanding solute-solvent interactions and also solvent macromolecular interactions. In this study, following combinations of binary liquid mixture were studied.

1. 2- Propanone + methanol, + ethanol, + Benzene, + Toluene.
2. 2- Butanone + Methanol, + Ethanol, + Benzene, + Toluene.
3. Acetophenone + Methanol, + Ethanol, + Benzene, + Toluene.
4. Propiophenone + Methanol, + Ethanol, + Benzene, + Toluene.

At 298.15, 303.15 and 308.15 k temperature and at atmospheric pressure, the characteristic of present work was that it involves the study of Physical properties of liquid – liquid mixture involving strongly polar alcohols and non-polar aromatic hydrocarbon liquids in association with commercially used solvent at low temperature.

The results obtained from the various Thermodynamic parameters studied thermodynamic some light on the nature of intermolecular interaction between various binary mixture of aliphatic and aromatic ketones with polar and non-solvents. In case of these solvents there was negative molar excess volume attributed to the presence of chemical interaction and between the components there is presences of difference between free volume and molar volume.
result of geometrical fitting one component molecule into the other. The specific interaction was found in case of methanol are greater as compare to Ethanol.

In case of Ethanol Chain length Increases, Size increases and dielectric constant valves decreases, specific interaction decreases and structural contributions arising for the geometrical fitting found to decrease. The specific interaction was found in non-polar solvents benzene and toluene is greater as compare to polar-solvents methanol and ethanol. In case of non-polar solvent benzene and toluene as chain length decreases, size decreases and dielectric constant value increases, specific interaction increases and the structural interaction which result geometrical fitting found to increases.

The specific interaction was found in aromatic ketone with polar and non-polar solvent are greater than aliphatic ketone with polar and non-polar solvents. This leads to of aliphatic ketones chain length increases, size increases and dielectric constant value decreases, specific interaction decreased, specific interaction decreases and structural contributions origin from the geometrical fitting found to decreased.

In case of binary mixture of aliphatic ketone with polar solvent, are viscosity deviation is negative and non-polar solvent it is positive. This attributed to in aliphatic ketone with polar solvent dispersion interactions are greater than aliphatic ketene with non-polar solvents. In case of binary mixture of Aromatic ketone with polar and non-polar solvent, viscosity deviation was found to be positive and in aliphatic ketones it is negative. This attributed to that in aromatic ketone specific interaction dominates the dispersion interaction.

The present study is the worked on physicochemical properties and to collect new experimental data on various properties like densities and viscosities for the binary liquid mixtures at varies compositions and at three given different temperatures Furthermore, the study involved the evaluations of the excess functions and interaction parameters from the experimental data and interpretation of the intermolecular interaction and testing of various existing theoretical models.

Therefore in view of those considerations, the study of liquid –liquid system involving ketones are the primary solvents, was undertaken. In chemical industry, both aliphatic and aromatic ketones are polar in nature so there interaction with polar solvents methanol and ethanol are dipole –dipole interactions. Whereas interaction with non-polar solvents benzenes
and toluene are dipole-Induced dipole interactions. The polarity order found in ketones are propan-2-one < 2-Butanone < Acetophenone < propiophenone. This attributed to specific Interaction order between ketones with polar and non-polar solvents are propiophenone > acetophenone > 2-Butanone > 2-Propanone.

Increase in temperature effect on physical forces which result that breaking of physical bond between like molecules and increase in structural interactions between unlike molecules causes’ geometrical fitting between different molecules because of better interstitial accommodation due to thermal agitations in all system are observed. The presence of specific interaction structural interactions and challenging task, Dispersion Interactions observed in case of binary system involving commercially important solvent.
4.3. Future scope of work

This study can be extremely helpful in elucidating the change occurring in the various liquid mixture systems. Since the present work involves aliphatic and aromatic ketones interaction with given solvent. The Study can be put into use to understand solvent-solvent macromolecular interactions and correlate to its therapeutic effects. The study can be further extended to study ternary liquid mixture system and their interaction parameters. Moreover, this study can be co-related with dielectric constant measurements, heat capacities from calorimetric measurements, surface tension measurements, and entropy measurements, Enthalpy measurements, Infrared and nuclear magnetic resonance spectroscopy to enhance. The Further development and to explain the molecular Interaction Using different models quantitatively which is rather challenging task.