BHARTIYA SANGEETATIL SWARANCHE MAHATVA VA STHAN

A

THESIS SUBMITTED

TO

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

FOR

THE DEGREE OF DOCTOR OF PHYLOSOPHY

IN

MUSIC

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VADODARA

"Bharatiya Sangeetatil Swaranche Mahatva va Sthan"

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Declaration

I have been learning, practicing and singing Indian classical Music for last many years. While doing this I realised the importance of swara in Raga. North Indian Classical Music is sung and practiced in kharj, madhy and tar saptak using shudhda and vikrut 12 swaras. Ati komal, Ati-ati komal, teevra, teevratam swaras are automatically used according to the quality of individual's vocal chord, and as per the requirement of the mood of raga, which creates proper ras, bhav, and melody which is the aim of Indian classical music. This gives the same swara a different sthan or shruti (frequency) in different ragas.

This is purely my original idea and I have tried to prove this by doing lot of reference work visiting various libraries and doing practical work on computer using Matlab Software.

Shrikant Lagu
(student)

THIS IS TO CERTIFY THAT CONTENTS OF THE THESIS ENTITLED **"BHARATIYA SANGEETATIL SWARANCHE MAHTVA VA STHNAN"** BEING SUBMITTED BY SHRI SHRIKANT LAGU TO FACULTY OF PERFORMING ARTS, THE M.S. UNIVERSITY BARODA, FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHYLOSOPHY, IS A RECORD OF ORIGINAL RESEARCH WORK CARRIED OUT BY HIM UNDER MY SUPERVISION AND GUIDANCE.

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NOTE

Bharatiya Sangeet is basically divided in two major streams, after 13th century. 1)North Indian classical music 2)South Indian classical music.

North Indian classical music, which was developed in North India. and South Indian classical music, developed in South India.
Both the streams are called Bharatiya Sangeet. My Thesis titled 'Bharatiya Sangeetatil Swaranche Mahatva va Sthan' mainly deals with details of North Indian Classical Music.

Synopsis

Importance and status of a Note in Indian classical music.

Introduction :- The following aspects are explained.. North Indian classical music as an art and science, Historical, Mathematical, Scientific, Geographical, Educational, Discipline & freedom ect.

The thesis contains 5 chapters , the summary of the five chapters is given here below…

Chapter 1 :- The 1st chapter deals with the definition of Indian music as stated by Pt Sharangdeo in his book 'Sangit Ratnakar'. Definition of 'Nad', characteristics of 'Nad', different kinds of 'Nad', and properties of 'Nad' is also given while explaining Indian Music.

Chapter 2 :- This chapter starts with the Definition of 'Shruti' and 'Swar', then fallowed by how the 'shruti' is converted in to 'swar', how the No. 22 shruties is developed by 'Shadj-Pancham bhav'. 'Chatusarana Experiment' conducted by Bharatmuni is explained and shruties obtained from 4 saranas, their inter-relation is also described.

Chapter 3 :- This chapter deals with 'Swar'! Definition of swar, how the 7 swaras are developed from 3 basic swaras-Udatt, Anudatt, and swarit mentioned in 'Rugveda' is given. According to Pt. Ahobal there are 29 swaras and swara's origin, colour, God (Devata), etc is also given. Pt Ramamatya and other experts's views about 'swara' is also mentioned.

Chapter 4 :- 'Sthan' of swar is depends upon various factors.. like 1) time of singing of raga 2) Aroh and avaroh of swars in raga 3)'vadi' and 'sanvadi' swaras, 4) swara's nyas, 5)Charactor (swarup) of raga, 6)emotions expected in raga,(bhav) 7)Words of Bandish,
8) Artist's personality, 9) Artist's mood and 10) most important Ragang of raga. All above factors are discussed in this chapter.

Chapter 5 :- Description and Details of the experiment conducted to prove the sthan of the same swar is different in different raga are explained in this chapter. Vocal recordings of swar is used to measure the frequency of particular swar in aroh and avaroha. Matlab software is used to get a graphical presentation of the frequency of swar. The graphical presentation was obtained which goes to prove the sthan of a same swara is different in different ragas of North Indian classical music..

PURPOSE

The purpose of doing research on "Bhartiya sangitateel swaranche mahatva va sthan'.

The music came in existence on the earth right from the existence of a human being! The man started expressing his emotions or thoughts through different sounds. Ever since the dawn of civilization, man has been giving expression to his feelings in music in some form or other.

The medium of music is sound. The sound with uniform frequency is called musical sound. In Indian music musical sound is called Nad. The continuous series of sound of the same pitch which is melodious and gives aesthetic joy is called swara. The word swara is composed of two letters. 'swa' and 'ra'. The letter 'swa' stands for the word swayam, i.e. by itself and 'ra' stands for rajate or ranjayati, i.e. shines or delights. Swara or tone is that which shines or delights by itself without any extraneous aid. The music is a language of notes or swara and every note or swara of music is 'nad' of soul.

The various permutations and combinations of 12 swaras of Indian classical music create Raga, but all combinations of swaras do not create raga in music. Only those combinations of swaras which are melodious, pleasing, express different mood, rasa, emotions (bhava) are raga. The definition of Raga is therefore 'Ranjayati iti raga'

In any raga the selected combination of swaras should be properly placed while singing or playing an instrument ,only then expected mood, rasa, and bhava (emotions) of raga will be experienced. If the placement of swara is even slightly deviated from it's proper place then presentation of raga goes out of tune. Therefore swara has got lot of importance in North Indian classical music.

I am practicing and singing North Indian classical music for last many years. I realised while singing that same note or swara behaves differently in different ragas of North Indian classical music. For Ex. Teevra Ma in raga marava, yaman, multani and todi or 'Komal gandhar' in multani, todi, asavari are different. Now actually there is no difference in shruti and swara. Out of 22 shruties the combination of 5,6 or 7 etc. shrutis are selected for particular raga. i.e. those shruties are called swaras.

2) Hypothesis

When same note or swaras placed differently in different ragas i.e. on different shruties to express proper mood, rasa, and bhava of raga that means the sthan of the same swara in different ragas is different. I therefore selected the title of my thesis **'Bharatiya sangeetatil swaranche mahatva va sthan '**

3) Data collection

I tried to analyse and find out why it should be so. What are the reasons? Is it related to 1) Time of Raga, 2) Aroh and Avroha of raga, 3) Vadi Sanvadi of raga 4) Nyas of swar 5) Swarup of raga 6) Bhav of raga (Emotions), 7) words of bandish 8) Artiste's personality, 9) Artiste's mood, or 10) Ragang.

I studied all these aspects by visiting various libraries and referring some books, like Sangeet Ratnakar by Sharangdeo,

Natya Shastra by Bharatmooni,

Sangeet Parijat Praveshika by Pt. Ahobal,

Swarmel Kalanidhi by Pt. Ramamatya,

Bhartiya Sangeet ka Itihas by Dr. Sharadchandra Paranjape,

Indian Music by Dr. Thakur Jaideva Singh,

Bhartiya Sangeet ka Itihas by Dr. Thakur Jaideva Singh etc and many others.

4) Actual experiment

After collecting the sufficient data I thought of doing actual experiment to prove the fact that in North Indian Classical Music the sthan of the same swara is different in different ragas.

I recorded the same swara in different ragas, say for example komal gandhar in raga Todi, in raga Mulatani and raga Asavari, found out their frequencies and represented graphically by using Matlab software on computer. I have made similar experiments with swaras like komal Rishabh, komal Dhaivat, komal Nishad etc. I got the results which go to prove my idea that in North Indian Classical Music the shtan (Shruti) of the same swara is different in different Ragas.'

I did these experiments in UICT lab Mumbai.

5) Objective

I feel these findings will be useful to the teachers, students, and singers. These findings will help the artiste to use proper swar in proper raga to achieve the melody of raga which is the fundamental purpose of Indian music.

INTRODUCTION

Is music a science or an art? The answer to this question naturally depends on the meanings we give to the word music, science and art. Music is said to be highest of the fine arts and that is true. According to the Hindu conceptions there are 14 Vidyas and 64 Kalas. Vidya is primarily knowledge of God and by implication it also means branches of knowledge leading to this goal. Kala means presentation of knowledge artistically. It is worth noting that music is included both under Vidyas and Kalas, as Gandharva Vidya and Sangeet Kala. It may therefore be safely inferred that Eastern conception of music was and is that it had two aspects, one spiritual and the other aesthetic. The purpose of music is to have the knowledge about God by worshiping. The ultimate purpose of Vidya and Kala is to have knowledge about human being, the world and the God.

Science is essentially related to intellect and mind and Art to emotion and intuition. But all the same Science is Science and art is art; their methods are different, though one can help other by giving a balanced background. In the development of musical art it is the *Lakshya* that is the soul of the art and *Lakshan* comes in only for purposes of the codification. *Lakshna* should not dominate *Laksha* because it will hamper the creativity and emotional feelings of the art. In case of *Tal* and *Laya* also same principle applies; it should not hamper the ultimate purpose of music.

In music *Swara* has lot of importance. The application and expression of *swara*, while singing any raga should maintain proper melody, *Bhav* and delicacy, Rasa and emotions. So that singer will enjoy himself and it will touch the heart of the listeners. Now a days singers are singing mechanically and mathematically. Pt. Venkatamakhi initially mentioned 72 *mela ragas.* as a theoretic possibility , he did the classification of ragas in 20 *mela ragas,* thereafter someone has written more male ragas and added to Chaturdandiprakashika. Pt Vishnu Narayan Bhathdkande did the classification of Ragas in 10 *Thaats*.

The Music is essentially an Art, but it uses the methods of Science for its own purposes. The use of science should not spoil the basic purpose of music. Indian music satisfies the heart as well as mind and goes deeper down into realms where emotion and intellect coalesce into intuition. Its appeal is primarily to the emotions; but sublimates these emotions into impersonal experiences where the dualities merge into a great synthesis, where joy and sorrow merge into ineffable bliss.

SOME ASPECTS OF MUSICOLOGY

Musicology means to cover all knowledge relating to music except actual performance. It has a very wide range and covers topics of great cultural and aesthetic interest. Generally Musicology means only the theoretical aspects of music such as the *Shrutis, Thaat* or *mela* scheme, derivation of *Janya* ragas and so on.

This is only a minor part of Musicology. There are some other aspects covered by Musicology such as:

1. Historical:- Among the living organisms in the nature human being is supposed to have lots of feelings, ideas and thoughts. A human being always tries to achieve and develop these things and gets ever-widening experiences and so its concepts of right and wrong, beautiful and ugly, justice and injustice also evolve. Of course there are certain fundamental basic truths which are eternal and unchanging. Human being used to express his thoughts and feelings by using different voices. The idea and existence of music was from the existence of human being. To have the knowledge about particular thing, a common principle is to give hundreds of examples about the thing and make a Rule. According to principle from the effect of different voices and sounds, human being developed the idea of music and music came in existence.

Anything if you want to put it properly and scientifically in writing, one has to experience it for long time and make a Rule. This is an empirical knowledge obtained from the experience. The science means properly organised knowledge (systematized knowledge) obtained from the study of empirical knowledge. The science of music is developed by the same process. The music of today is certainly different from what it was in Vedic period or Ramayan and Mahabharat; but the today's progress in music is due to / depends on olden days music.

Mathematical:- Mathematics has been always useful to study *shruti*, *shruti intervals and frequency*. Mathematics is also useful for the development of various Ragas and Talas,. How many Ragas will be possible from 12 swaras?. Tala system of Bhartiya sangeet, can be explored or derived from mathematics by permutation and combination methods. We have to see how many combinations of swaras or talas are useful for music.

Mathematics and Music have gone hand in hand in ancient Greece. Pluto insisted on a knowledge of music and mathematics as the part of any one who sought admission to his school. Similarly Pythagoras laid down the condition that would be pupil should know Geometry and music. Music and mathematics together lead to true mysticism. We have to observe one thing that mathematics should not disturb the melody of music.

Scientific (Acoustics) :- Music is based on sound and a knowledge of sound. from a scientific standpoint will be an advantage. For a performance to be completely effective several factors need to be considered and utilised.

Voice production:- Of the kind required for the particular system of music in view can be done scientifically more quickly than otherwise. The concert hall has to satisfy certain conditions if the music performed is to come out at its best. Especially in dealing with musical instruments and their structure some scientific knowledge comes in handy. A knowledge of the quality of the material used, of the principles underlying resonance, of the laws of vibrations of strings and air columns and such other matters, is very valuable. Of course some people deal with instruments in an empirical way, but scientific approach will save time and ensure correctness.

Geographycal:- Some persons may wonder where Geography comes in music? But a little thought will explain the point. It is a well-known fact that climatic conditions of a place have a great influence on the voice and the materials used for instruments. It has been observed that in certain areas the voice has a natural tendency to be nasal; the climate at times influences even vocal inflexions. The language spoken in these areas bare the stamp of

this climatic influence. Similarly in some climates the average voice is subdued, soft and mellow while in some places it is bold, vibrant and forceful.

Psychological: All fine arts directly act on human emotions and music especially has profound influence on our inner nature, feelings and thoughts. This has been recognised all times. Ragas or melody mould are unique aesthetic entities each with its characteristic influence and emotional effect. The vibrations set up by music do not stop with the ear; they induce vibrations in our subtle nature, the entire human nature is affected by them. There are many yet unrecognised effects of music whose study will yield wonderful results. The power of music to cure diseases has been recognised in ancient times. A Chinese book speaks thus of good music "under the effect of music, the five social duties are without admixture, the eyes and the ears are clear, the blood and vital spirits are balanced, habits are reformed, customs are improved the Empire is in complete peace".

Pedagogy:- The teaching of music is another interesting branch of musical studies. There is no point in bemoaning the passing away of the old *Gurukula* system. We cannot bring it back. An intelligent system of musical instruction related to the nature of the musical art on the one hand and the psychology of the learner on the other has to be evolved. Now a days some people study music are not all out to become professionals; many study the art in the college stage with a view to acquire the power of intelligent appreciation of the art and help its cultural growth or to get degree. Hence the accent in such cases is on the cultural rather than an

performing side. So the scheme of musical studies has to be planned so as to meet the needs of the various groups of people who come to study music.

Musicology deals with all these aspects and many more. The musicology should be used to make the progress and the development of the art. The artist and musicologist should come together and think for the progress of art. Those who learn music and deliver the same as it is are called *Gayak* (singers). Those who learn the music and have the knowledge of musicology are called *Nayak.* Those who know the art, musicology and the poetry of music are called *Vageyakar.* The purpose of any art is with minimum possible efforts, to make maximum effective. Many times we observe in music the artist delivers his art with lots of efforts but still it does not achieve the expected best effect. The artiste should know his limits and knowledge and then he should deliver his art which will have good effect on the listeners.

The artist should think about all these above mentioned points. He should try to understand the arrangements, the listeners mental ability, liking etc. He then can make the listeners spell bound and forget all other things but music. The art to be effective and beautiful and progressive science is definitely required.

DEMOCRACY AND CREATIVE MUSIC

There is a liking and appreciation of the art music developed in people because music gives them enjoyment. In a way this is healthy sign, at the same time we have to see that standard of music should not go down. One of the most effective expressions of the soul of a nation is through her

music and when there is a general renaissance in the life of a nation this is evidenced also in her musical expression.

Music (as well as other fine arts) was in the past a privilege of a chosen few, kings, *zamindars* and rich people patronized music and musicians. The musician had no anxiety about his livelihood. He was free to pursue his art and keep it pure and high, irrespective of the demands of the people. It was as it were, only by sufferance that the masses had occasion to listen to these masters. But all that now has changed. As many other things, music also has passed on from the hands of the aristocratic few to the general mass. Music *Sabhas, Mahaotsav* and other similar organisations have made it possible for the common man to enjoy as much and as heartily as the zamindars or maharajas of the old. Musicians are much in demand and one may say their needs in life are assured, at least in most cases.

But...and it is a big "but".... what is the effect of this democratisation on the art of music? Now the patronage has shifted from the few to many. The average musician of today cannot entirely depend upon the patronage of the aristocracy. He looks for his support to the people at large, and so has to keep in good relation. However intense and sincere the desire of the public for encouraging music may be, the moment the standard of high class music is left entirely to be determined by the mass of listeners, the art is bound to deteriorate. An honest musician, who on the one hand desires to be true to the ideals of traditional Indian Music and on the other wishes to please the listeners has to live a life of compromise between the ideals and the actual necessities of life. Whether the public has the capacity to know the subtleties of the art music? So that they can describe the standard of music. People should know that the purity and standard of music should not

go to the low level. The Melody, *Bhava* and *Rasa* which give the satisfaction of enjoyment to listeners heart should not be lost.

DISCIPLINE AND FREEDOM IN MUSIC

Some of the deepest truths of life are best expressed only in paradoxes, in apparently contradictory terms. When we talk of Freedom and Discipline at the same time it may sound strange. But a little thought will indicate that not only these two are not inconsistent but complementary to each other. Absolute freedom is an impossibility in the manifested Universe. If everyone claimed absolute freedom the result will be chaos. Our freedom in the world is conditioned by the freedom of others. Disciplined freedom alone will lead to stability and progress. In fact any cultural achievement is the result of self imposed discipline. Only discipline is also not proper because then cultural progress will not take place and music will be monotonous.

Nature is full of charm and beauty, but in what may be called random distribution. It is the privilege of the artiste to select from the abundance of nature's gift in of beauty sound, color, form and so on and give a new shape which will enhance that beauty a thousand fold. Nature is full of pleasing sounds but the musician selects such of these as can be prepared beautiful garland of sounds. That is music!

There is a science in music also. Sound, the properties of sound, frequency *shruti*, *Nad*, *Swar* etc. When *shruti* becomes *swar* and by arranging different *swaras* in *Aroha* and *Avaroha* different Ragas are

created. From every Raga different *Bhava, Rasa* and Melody is expected and accordingly nature of the *swara* should be.

If we imagine Shadja of particular frequency then as per mathematics *Komal Rishabh, Komal Gandhar, Teevra Madhyam* etc will have frequencies and their *sthan* accordingly. The *sthan* of the same note in different Ragas will not be as per mathematics but it will be as per expected *Bhava Rasa* and Melody i.e. the same *swar* will have different frequencies in different Ragas. The importance of *swara* in Raga is always accepted. Here the effort is to prove the importance of swara and the sthan of same swara in different ragas is different.

Chapter 1

NADA

In Bharatiya Sangeet musical sound is called *NADA* and *NADA* is called *"Brahman"* or Divine Reality itself.

Three things are essential for any sound to be heard. a) vibrating body b) medium like air, liquid or solid through which the vibrations travel c) a receiver as an 'ear'

Science defines a tone or musical sound from the point of view of its physical structure. *Bharatiya Sangeet* calls a tone as *swara.* The work done on Bharatiya Sangeet lay emphasis on the resonant character of a Swara and it's aesthetic effect. *(Indian music, by Thakur Jaideva Singh,xxxvIII)*

The music came in existence since the existence of human being on the earth and it has captured the atmosphere.

As the flowers blossom naturally in the nature, music has a dialogue with the soul (*Atma*), every *SWAR* in music is *NADA OF ATMA* (soul) and *ATMA* is part of *PERMATMA.* Music is therefore pleasant and establishes peace in the heart of a listener. The expressions of human being with *Bhava, Rasa* and Melody is Music.*(Rasvedh, By Uppalvar B.V.)*

Pandit Sharangdev gives the definition of Music in his book Sangeet Ratnakar as follow:-

eveceLÙe ßee MeeÁoJee: meejeÉej ecece JÙeOeeIe I ieeIe JeeÅe IeLee veòe $eÙe meieeIeceÛÙeIe II21II

As per the definition Music includes *Geet* (song or poem), *Vadya* (instrument) and *Nritya* (dance).

All these three make music. Music is of two types.

1) Marga sangeet 2) Deshi Sangeet

Marg sangeet is discovered by Brahmadeva and Bharat and others displayed it in front of God Shankara. Deshi sangeet is the sangeet comes from different states or localities as per the liking of people and which is enjoyable.

Geet, Vadya, and Nritya

Nritya (dance) follows *Vadya* (instrument) and *Vadya* follows *Geet.* Therefore Geet is supposed to be the prominent.

Enjoyable combination of *swaras* is called *Geet*. *Geet* is again of two types.

1) *Gandharva* and 2) *Gan*.

Gandharva is delivered by *Gandharva* for the best purpose and is of definite type. Gan is a poem (*Geet*) created by *Vagyeyakar* which follows rules of music and it is in particular Raga. The purpose is to please the public. *Geet* is the only medium to achieve *Dharma, Artha, Kam and Moksha*, the four principles of life. *(Sangit Ratnakar: Pg 12&19)*

Geet is developed from *NADA*, *Vadya* (instrument) and *Nritya* follows *Geet* therefore all these three are the part of *NADA*

The world is full of *NADA*. We cannot see the *NADA* but we experience it.

The existence of the world is due to Panchmahabhuta i.e. *Prithvi* (earth) *Aap* (water) *Tej* (light), *Vayu* (air) and *Aakash* (sky). If the existence of any one of these five is disappeared, then nothing will exist.

Therefore these *Panchmahabhuta* are important for the existence of the world. The creation of the world, presence and loss is due to the power

of God. The power of God is throughout the world. The world is full of power of God similarly it is full of *NADA.*

While thinking about the God the mind is engrossed, one forgets other things, achieves total concentration. Similarly while listening to *NADA* total concentration is achieved therefore such *NADA* is called God.

The power of God is "*BRAHMA'!* The world is full of *"BRAHMA"*, therefore it is described as "*ANNABRAHMA*", *"STHALABRAHMA*", *"JALABRAHMA*","*TEJABRAHMA".* Similarly the power of NADA is called "*NADABRAHMA".*

There are lot of similarities in *PARABRAHMA* and *NADABRAHMA. PARABRAHMA* is every where in the world similarly *NADABRAHMA* is also everywhere in the world. We cannot see *PARABRAHMA* as well as *NADABRAHMA. PARABHAHMA* is all time (*trikal*). Similarly *NADABRAHMA* is also all time.

We cannot understand or find out what is *PARABRAHMA* as well as *NADABRAHMA.*

Shadja is a power and part of God. NAD as *Shadja* is everywhere in the world. Any *NADA* can be taken or imagined as a *Shadja* while singing.

While singing, a singer fixes one swara as *Shadja* and then he makes combination of lower or higher *swaras.* Human body has various parts. Shadja is imagined as a body having seven swaras. It is called *Swaradeha or Shaririveena* (Vedant va Gayan: By S.V. Paranjape. Pg 1to9)

Kinds (types) of *NADA* :- Sound which is the base and medium of music is of two types 1) sound which is useful for music is called *NADA*

2) Sound which is not useful for music is called noise.

Bhautik NADA:- This is the *NADA* developed in the human body.

"BRAHMA" is *chaitanya swarup* (energetic), *Anand Swaroop* (full of joy), *Svatah Prakashman* (self delights) and *Nirmal* (pure). It is called God. It is *Advitiya* (incomparable), *Janmarahit* and *Mrityurahit* (without birth and death), *Vyapak* (capturing the world), *Nirvikar* (without any feelings), *Nirakar* (without any shape), *Sarva shaktiman* (most powerful) and *Sarvadnya* (having complete knowledge). Living body is part of *BRAHMA.*

These living bodies (*Jeevatme*) are controlled by happiness, sorrows and sins etc and they have the things in their fate as per their life and deeds in every birth. They have another living body which will never be destroyed till the *Moksha* (freedom from everything)

The ' *sookshma'* (finest) body is of *Panchamahabhuta, Indriya* (parts of body) and *Pran* (life). The *Aaj Paramatma* for the experience of these living bodies create the world. *Atma* and *Paramatma* destroys the world to give rest to living bodies. The creation of the world and destruction goes on continuously. The world and living bodies are not different from *Atma.* This *Atma* with its power creates the world.

Atma is responsible in creating first *Akash* (sky) , from this *Vayu* (air) , from this *Agni* (fire), from this Pani (water) and from this *Prithvi* (earth). These *Panchamahabhuta* (five important elements) is the body of huge *BRAHMA.*

'BRAHMA' created *'BRAHMADEVA'* and gave him *Vedas.* From the words of *vedas* this *Bhautic* Nature was developed. As per the order from BRAHMA, BRAHMADEVA created *Prajapati* (creator of living bodies). Creation of living bodies is of four types.

From *Gham* (perspiration) , *Udbheda* (from the soil),- trees, from Egg-birds.from V*eerya*- human beings.

But for NADA human body is useful. (Sangit Ratnakar By Sharangdeo: Marathi translation by Prof. G.H. Taralekar. Pg. 12)

In human body when *Atma* feels like talking, it induces mind, mind induces *Agni* (fire), *Agni* induces *Vayu* (air). Vayu in Brahmagranthis travels upward side through *Nabhi* (stomach navel?) *Hridaya* (heart) kanth (vocal chords) *Mastak* (head) and *Mukha* (mouth) and creates sound.

NAD in these five places is called *Atisukshma* (finest) *Sukshma* (fine) *Pushta, Apusht and kritrim* (artifical). *NA* is the name of Prana or Vayu (life) and *DA* is the name of *Agni* (fire). It is therefore called *NADA* because it is created by the combination of *Vayu and Agni*.*(Sangit Ratnakar by Sharangdeo. Pg 54)*

The vibrations of *BHAUTIK NADA* are continuous and with specific intervals. This Bhautik NADA created in body is of two types.

1) *ANAHAT NADA* 2) *AHAT NADA*

Both these NADAS are created in body.

Deenlee veenleçÛeele eÉOee veeoe eveieÅele~

mee Ùe Øekeâeçele ehe[lemceele eØeÙeeeYeOeeÙele~~3~~ (Sangit Ratnakar: pg 19)

Deenlee veenleçÛeele eÉOee veeoe eveieÅele

le$ee veenleveeo le ceveÙe: meceheemele~~14 (Sangit Darpan pg 4)

ie®heeo° ceeieCe ceekeleo ve le jpekeâce

me veeomlJeenlee }ekeâ jpekeâe YeJe Yepekeâ:~~15 (Sangit Darpan pg 4)

1) *ANAHAT NADA* :- Is created without any inducement or hammering. It is not useful for music. As per the advice of *Guru* (teacher), *Yogi* (student) studies *ANAHAT NADA.* It relives human being from birth and death cycle.

2) *AHAT NADA:-* It is the sound produced by striking some body; which has continuous vibrations and with specific intervals and which is enjoyable. It is called NADA. The NADA does not creats music but its property is useful for music (Lakshan)

ATIBHOUTIK:- Scholars consider four different types of NADA. *Para* (heje) *Pashyanti* (heçÙeevle) *Madhyama* (cœOÙecœe) and *Vaikhari* (JeKeje). Out of these Madhyama is considered to be useful NADA for music i.e. basic thing required to produce *SWARA.* (The four types are considered as *VAK* but *VAK* includes *NADA* and *VARNA OR VYANJAN*) This type of *NADA* is called *ATIBHAUTIK*, this does not clarify how music is originated in the heart of human being.

PSYCHOLOGICAL OR PSYCHOPHYSICAL

Darvin's principle of origination of music is when man started creating sound by following animals and birds and music was originated. The present scholars do not agree. After studying olden days according to them music is for worshiping God and Goddess.

According to Karl Stumf when man started expressing his feelings by different sounds, the language was originated. Language is prior to music language is responsible for music.

This statement is also not agreeable because in music the importance of swara lies in its sweetness, melody and not in its pitch. If we think properly

we can know that the origin of music is interjectional cry. *(Bharatiya Sangitka itihas: By Thakur Jaideva Singh, pg 1&2)*

In human body *NADA* is of three types. *Nada* originated from heart is called *MANDRA*, from vocal chords is called *MADHYA* and from head is called *TARA.*

The Madhya is double in pitch of Mandra and Tara (higher) is double in pitch of madhya. (*Sangit Ratnakar By Sharandeo, pg 55)*

Properties of NADA :- We can differentiate one NADA from other because of its properties. These properties are very much useful in producing music.

There are three aspects of a musical sound or NADA, Pitch, Force or loudness or intensity and Timber or quality of sound.

PITCH:- Pitch is the degree of acuteness or graveness of a tone or NADA. Every NADA has specific vibrations. Pitch depends upon number of vibrations. Pitch depends upon number of vibrations or frequency of the *NADA.* The more the vibrations higher the pitch. The lesser the vibrations lower the pitch.

For example if the frequency of *Shadja Sa* is 240 and frequency of *Rishbha Re* is 270 then frequency of Komal RIshabh is 256. 12 swaras in Bharatiya Sangeet are placed or fixed on definite place or *Sthan.*

Loudness or intensity:- There is definite distinction between pitch and loudness. Higher the pitch is not necessarily louder than that of lower pitch. But the loudness or intensity refers to the force with which a note or *NADA* is sounded not to the pitch.

Without changing the frequency of a *NADA* if one says in higher voice and then in lower voice, we know the difference. A singer can make his singing attractive because of this property. Pitch depends on frequency of vibrations and loudness depends on the amplitude of vibration, the greater the amplitude the louder the sound.

Timbre or Quality:- It is the property of *NADA* which shows from which medium *NADA* is produced. Suppose you are listening to an ensemble of instruments all tuned to the same pitch and being played with the same intensity you still recognize the tones of different instruments because the quality of the tone of each instrument differs. The same is the thing with human being. Different persons have different tonal quality therefore without seeing the artist we can know who the singer is. Tonal quality is technically called Timbre .*(Sangit shastra Parichay; by Madhukar Godase. Pg 26 &27)*

Chapter 2

SHRUTI

The definition of SHRUTI is " *'ßeÙele Fele ßeele:'*. The sound clearly herd by the ear.

In human body *'NADA'* is produced by the combination of *Agni,* (fire) and *Vayu* (air) in *Bramh Granthi* . It travelles up words through the passage. (*NADA*) connected to heart which has 22 horizontal passages (nadis). When the vayu passes though it creats / makes 22 sounds. They are called *SHRUTIES*. Similarly *KANTH (voice box)* and HEAD *(mastak)* also have *22 SHRUTIES*

Ahat nad is produced in *Anahat Charka* in the heart It is called *Mandra* The nad produced in *Vishuddha Charka* in kanth is called *Madhya*, *Nad* produced in *Sahasraar Charka* in (*Mastak*),head is called *Tar (Sangit Parijat Praveshika;By Pt Ahobal)*

In practice *Nad* is of 3 types. Nad developed in heart is called Mandra, devolped in voice box is Madhya, and developed in head, Mastak ,is called tar and it is in double proportion.

The vayu from Bramh granthi travels upword it makes sound at 5 places (shtan) 1. Nabhi, 2. Hriday (Heart), 3 Kanth, (Voice Box) 4.mastak, (head) 5) mukh (mouth). These are called Nad sthan or place. *(Sangit Ratnakar; pg55)*

Shruti and Swar are audible therefore they are not different. Nad which is soft, melodious, which gives pleasure to a listner and come after shruti is called swar. Swar is define as, 'mJelee j_peÙeele ßeeleeÛeòe me mJej GÛÛele'. *Swar* word comes from the combination mJele:±j_pe From *swatha swa* is

taken and from *ranj ra* is taken, that is how swar word is form. *(Sangit Ratnakar ;pg54)*

Abhinav Gupta has given the definition of shruti very clearly

'ßeeleçÛe veece ßee$e iecÙece Je}#eeCeÙece ÙeeJelee çeyoveelheÅele' Sound which we can hear clearly by our ear and differentiate from other sound is called shruti. *(Bharatiya Sagitka Itihas; Thakur Jaideo Singh. Pg 324)*

Abhinav Gupta also had established that *Sanskar* , *Urdhva Ssparsh* and *Nishkas,* these three principles are creating *swar* and group of the *swar* is called *Gram*.What *Sanskar* and *Urdhva Sparsh* means and how *shrutis* become *swar*, to know this you should know what is *Antargat shruti* and *Swargat shruti.* In *'Bhruhatddeshi', a book of Matang, Vishwavasu* has said

ßeJeCeevõÙe «ee¢elJeeo OJeevejJe ßeeleYeJele ~

mee Ûekeâeehe eÉOee %eÙee mJejevleeJeYeeiele: ~~

eveÙeleßeelememLeeveeo ieeÙevle mehleieeele<e ~

lemceele mJejielee %eÙee: ßeleÙe: ßeeleJeeoeYe: ~~

Devle:ßeeleeJeJeepevÙee nÙevleßeleÙee celee: ~

Sleemeeceehe ÛeçJeÙe e>eâÙee«eeceeJeYeeiele: ~~

It means the sound which ear can receive is called *shruti* and *shruti* are of two types 1) *Antargat shruti*, 2*) Swargat shruti*

Aantrgat shruti means *shruti* between two swaras and shruti which become *swar* is called *Swargat shruti*.

Urdhva Sparsh and S*anskar* are two important factors in connection with shruti. Shruties are not free, steady, and independent but they do *Urdhva Sparsh* (touch each other) each other. And as a sound , they are movable. Previous *shruti* offers *Sanskar* to next *shruti* and go ahead. When they reach in groups of 4,3,2 they turn in to *swar*. That is shruti becomes *swar*.

is *Swargat shruti.* When *shruti* attains *swar* then *swar* attain *Swasanvedya* (self appearance, without anyother help). *Swar* with its power and melody appears itself. *Sharangdeo* therefore defines *swar* as *swatha ranjayati iti swarha*

Abhinav Gupta said that there is one more principle responsible in *shruti* attaining swar that *NIshkas* (dropping out)

On 4th *shruti* appears *Shadga,* there after 3 *shruti* (one *shruti* less) appears *Rishabh*, thereafter 2 *shruti* (one *shruti* less) appears *Gandhar.* This dropping out of *shruti* Abhinav Gupta calls *Nishas.*

Abhinav Gupta also said that there is no *swar* more than 4 *shrutis* and less than 2 *shrutis* 'leve hejceeLele: $eÙe mJeje: meejiee:, heOeveÙe: ~ceOÙecemle OeJekeâmLeeveeÙee ceOÙeceleJeeOJe ~~'

He says actually there are 3 *swars* , Sa, Re, Ga, and Pa, Dha, Ni, *Madham* is in the middle of these seven *swaras* . It is steady. The number of *shruties* of *Sa* and *Pa* are same that is 4, No. of *shruties* of *Re* and *Dh* are same that i.e. 3, No. of *shruties* of *Ga* and *Ni* are same that is 2.

From this analytical experiment we get *Shuddh* gram of Bharat. Our old musician consider *shuddha swar* (pure note) is in that status which if it is lowered it will not remain *swar. Shadja* will be of 4 *shruties* and it can not be of 3 *shrutis*. Similarly *Rishab* is of 3 *shrutis* and *Gandhar* will be of 2 *shrutis.* If we lower or increase the *shruti* it will be *Vikrut* (not pure). *Swar.* In *Shadja gram Shadja, Rishabh, Gandhar, Madhaym, Pancham, Dhaivat,and Nishad* will be of 4,3,2,4,4,3,2 *shruti.* If we reduce *shruti* of the *swar* they will not be *Sa,Re,Ga,Ma, Pa, Dha, Ni.* If we increase *shruti* they will not be pure but *Vikrut.*

Similarly these *swar* in *Madyam gram Madhaym, Pancham, Dhaivat,and Nishad Shadja, Rishabh, and Gandhar,* they will be of 4,3,2,4,3,4,2. This status of *swar* is called *Shuddha gram*. It is not major scale.(*Bharatiya Sangitka Itihas; By Thakur Jaideo Singh. Pg 320 to 323)*

Different *ragas*, different *shruties* out of 22 *shruties* are used as *swara.* In some *raga 5 shruties*, in some 6 *shrutis* are used as *swara*. There are so many *shrutis* are finest distance but the old Pandits schollers of music) and even todays scholars agree that there are only 22 *shrutis* as per *Shadja-Pancham Bhava. (Consonance). (Sangit parijat Praveshika; Pt Ahobal)*

Alain Danie Lou in his book 'Introduction of musical scale' on pg 132 says while expressing *raga* presentation the required *swar* or used *swar* has many finest *shruti* in its limit of *shruties* , but when *shruties* used which are proper for musical presentation (expected melody) they are in consonance and are in multiple proportion. In *saptaka* (Gr of 7 swar), possible *Nad sthan* are 53, but in one *saptaka* group of *nada* having different expression can not be more than 22.

OeJeeßeele<e }eveeÙeeeceÙevlee %eeÙele mHeâšce ~ Dele: hej le jkeilееOve ve keâeÙecehekeâ<eCece ~~

There are 22 *shruties* which is proved by Bharatmuni if we consider that there are more than 22 *shruties* in one *saptak* then *shruti* will loose melody-

ßeeleYÙe: mÙe: mJeje: <e[pe<eYeieeOeejceOÙece: ~ heÛecee OeJeçÛeeÙe eve<eeo Fele mehle le ~~

Swars are originated from *shruties*. They are seven *Shadja, Rishabh, Gandhar, Madhyam, Pancham, Dhaivat and Nishad. (Sangit Ratnakar; Adhyay 1, pg 63)*

In criticism by Sudhakar also accepted 22 *shruti in Mandra, Madhya and Tar saptak each, as per Parshwadeo's book of 'Sangit Samay Sar'*. The names of 66 *shruties* are given bellow.

ceÕmehlekeâ	ceOÙemehlekeâ	lee j mehlekeâ
1) ceõe(Mandra)	veeolee (Nadanta)	FÕeje (Ishwari)
2) Deeleceõe(Atimandra)	eve<keâuee(Nishkala)	keâecee je (Kaumari)
3) leeje (Ghora)	ie{e (Gudha)	meJejeuee (Savarali)
4) leejJeje (Ghorvara)	mekeâuee(sakala)	YeeieJeeÙee (Bhogvirya)
5) ce[vee (Mandana)	ceOeje (Madhura)	cevee jcee (Manorama)
6) meecÙee (Saumya)	ieuee (Gali)	meemveiOee (Susnigdha)
7) mecevee (Sumana)	Skeâe#eje (Ekakshara)	eoJÙeeiee (Divyanga)
8) he<keâje (Pushkara)	Yeiepeelee (Bhrungjati)	meueeueelee (Sulalita)
9) MeeKevee (Shankhini)	jmeieelee (Rasgiti)	eJeõcee (Vidruma)
10)veeuee (neela)	mejepekeâe (Suranjika)	cenekeâe (Maharka)
11)Glheuee (Utpala)	heCee (Purna)	Meekeâvee (Shankini)
12)Deveveeemekeâe (Anunasika)	DeuekeâeejCee (Alankarini)	jekeâe (Raka)
13)lee<eJelee (Ghoshvati)	JeeeMekeâe(Vanshika)	ueppee (Lajja)
14)ueeve veeOe (Leen nada)	JeeCekeâe (Vainika)	keâeuee (Kali)
15)DeeJelevee (Avartini)	e$emLeevee(Trishtana)	me#cee (Sukshma)
16)jCeoe (Ranada)	memJeje (Susvara)	Deeleme#cee (Atisuksha)
17)ieeYeje (gambhira)	meecÙee (Saumya)	he°e (Pushta)
18)oelelleeje (Dirghtara)	Yee<eeiee (Bhashangi)	mehe°ekeâe (Supushtika)
19)veeeovee (Nandini)	Jeeelekeâe (vartika)	eJemhe°e (Vispashta)
20)ceõpee (mandraja)	meheCee (Sampurna)	keâekeâueee (kakali)

21)meØemeVee (Suprasanna) ØemeVee (prasanna) keâjeuee (Karali)

22)eveveOe (Ninada) meJeJÙeeheevekeâe(sarvavyapnika) eJemHeâeŠeIeYeeovee (Visfotatbhedini)

(Sangit Ratnakar; pg 55)

In practice it would be easy to know 22 *shruties*, therefore according to *Narad* their names are as follow.

<e[pe **(Shadja)**:- 1) Iee>ee (Tivra)2) keâceÉIee (Kumudvati) 3) ceOe(Manda) 4) ÚoeJeIee(Chandovati)

$e+<eYe **(Rushabh)**:- 1) oÙeeJeIee(Dayavati) 2) jpevee(Ranjani) 3) jeÒeâkeâe(Raktika)

ieeOeej **(Gandhar)**:- 1) jeõe(Raodri) 2) ›eâeOee(Krodhi)

ceOÙece **(Madhyam):-**1)Jee»ekeâe(Vajrika) 2)Øemeeejcee(Prasarini) 3) Øeeeleie(Priti)

4) ceepevee (Marjini)

heÛece **(Pancham)**:- 1)e#eIee(Kshiti) 2)jòeâe(Rakta) 3) meoeehevee(Sandipani)

4)Deeueeehevee(Alapini)

OeJeIe **(Dhaivat)**:- 1)ceoIee(Mandati) 2)jeenCee (Rohini) 3)jcÙee(Ramya)

eve<eeo **(Nishad)**- 1)G«ee (Ugra) 2)#eeeYeCee(Kshobhini)

These are 22 *shruties of saptak* according to Pandits.

Types of *Shruti*:- *Shruties* are of 5 types. *1)Deepta, 2)Ayata, 3)Karuna, 4) Mridu, and 5) Madhya*

Tivra shruti is *Deepta* type

Kumudvati, Manda, and Chandovati are of *Ayata, Mridu,* and *Madhya type*

Dayavati, Ranjani and *Raktika* are of *Karuna , Madhya,* and *Mrudu* type

Roudri, is of *Deepta* type, *Krodhi* is of *Ayata* type

Vajrika is of *Deepta* type, *Prasarini* is of *Ayata* type

Priti is of *Mridu* type, *Marjani* is of *Madhya* type

Kshiti is of *Mridu* type, *Rakta* is of *Madhya* type

Sandipani is of *Ayata* type, *Alapini* is of *Karuna* type

Madanti, Rohini, and *Ramya* are of *Karuna, Ayata* and *Madhya* type

Ugra is of *Deepta* type, *Kshobhini* is Madhya type *(Sangit parijat Praveshika; by Pt Ahobal. Marathi Tr by Sukhankar)*

Some factors like *Rasa, Bhav* etc are responsible for difference in *swara's sthan*(Difference in place of a note). Similarly due to the type of *shruti* also will make difference *in swar sthan*.. It is proved by Bharatmuni and fact is accepted by all Pandit even today that there are only *22 shruties* in a *gram* or a *saptak.*

Bharatmuni's Experiment of *Chatusarana* :--

Pratham sarana :-

Bharatmuni has taken two identical veenas in all respects and tuned in *shadja gram.* One Veena was kept constant *(achal),* and other Veena was kept veriable. *(chal)* The *Pancham* of *chal veena* should be lowered to such an extent that it should have consonance with *Rishabh* of *(Shadja-Madhyam Bhav)* constant veena. *Pancham* of *chal veena* is lowered, a same way other *swar* should be lowered.and *chal veena* should be tuned in *Shadja gram*. Then *Pancham* of *chal veena* will have consonance with *Shadja of chal veena (Shadja –Pancham Bhav)* and it will be of *Shadja gram* and with *Shadja of achal veena* it will be of *Madhyam gram* .

In this condition every *swar* of *chal veena* compare to *achal veena* will be one *shruti* low. This definite *shruti* is called *'Praman shruti'*.

Dvitiya Sarana :-

Lower the string of *chal veena* in such way that *Gandhar* and *Nishad* of *chal veena* should match with *Rishabh* and *Dhaivat* of *achal veena.* Now *chal veena* should be converted in *Shadja gram* as per *shruties* of *Gandhar* and *Nishad.* This experiment of *sarana* proved that swar of *chal veena* are

low by two *shruti* compared to *swaras* of *achal veena*. Or swar of *achal veena* are high by two *shruti* compared to *chal veena.* It therefore proved that *Gandhar* and *Nishad* has two *shruties.*

The following things are clear from the experiment of *dvitiy sarana.* In *pratham sarana,* every *swar* of *chal veena* (veriable) compared to *achal veena* (constant) is one *shruti* low, under this condition it is clear that every particular *swar* of *chal veena* will not match with the particular *swar* of *achal veena.* This goes to prove that any swar of *saptak* is not of one *shruti.* If any *swar* of *chal veena* would have been of one *shruti* then it would have matched with some *swar* of *achal veena.*

In *Dvitiy sarana* experiment Bharat said that every *swar* of *chal veena* should be lowed to such an extent that *Gandhar* of *chal veena* should match with Rishabh of *achal veena* and *Nishad* of *chal veena* should match *Dhaivat* of *achal veena.* It is clear from this experiment that all *shruties* are not of same measure. If all *shruties* would have been of same measure of *praman shruti* then Bharat would have said that every *swar* of *chal veena* should be lowered by one *praman shruti.* In *pratham sarana* measure of *shruti* was *praman shruti.* Abhinav Gupta has classified the measure of shruti in *dvitiy sarana.*

The all swaras of *chal veena* should be lowered by one *shruti* including *Pancham* By doing this *Gandhar* and *Nishad* of *chal veena* will match *Rishabh* and *dhaivat* of *achal veena* which shows all *swar* of *achal veena* are highr by two *shruti* compared to *chal veena*. This peculiarity of Rishabh and *Dhaivat* is called *shruti.* By this experiment we come to know what is shruti? *Nishad* of *chal veena* matching with *Dhaivat* of *achal veena* , and *Gandhar* of *chal veena* matching with *Rishabh* of *achal veena* proves that *Nishad* and *Gandhar* are of two *shruties*

(Shri Lalit Kishor Sinh has explained in his book Dhvani and Sangit ,the measure of *Praman shruti* and *shruti* obtained from *dvitiy sarana* as follows.

In *prathama sarana*, *chal veena- pancham* consonant with *Rishabh* of *achal veena (Shadja-Madhyam Bhav.), Pancham* of *chal veena* will be Shadja gramic with Shadja of chal veena and Madhyam gramic Shadja of achal veena. Therefore *Madhyam gram Pancham* measure will be
10/9 x 4/3 = 40/27.

The distance of this *Pancham* of *Madhyam gram* will be 3/2 - 40/27 = 3/2 x 27/40 = 81/80 or 5 Severt. This is the distance between *Guru swar* and *Laghu swar* and it is called 'comma'. In *dvitiy sarana Gandhar* and *Nishad* of *chal veena* match with *Rishabh* and *Daivat* of *achal veena* i.e the distance between *Guru* and *Laghu swar* is 23 Severts. It is called 'Lima'. Therefore second *shruti* is of one Lima ie 256/243.

The *Praman shruti* of Bharat is 'Comma ' of Pythogorus. The meaning of this great word 'comma' is minute distance. The distance 81/80 is between *Pancham* of *Shadja gram* and *Pancham* of *Madhyam gram*. It is clear from *Pratham sarana* that a smallest distance of *Prman shruti* , Comma is 5 severts and the distance of lima shruti is 23 Severts. Lima is translated by Acharya Bruhspati as *Mahati shruti.* From *dvitiy sarana* one thing is clear that any *swar* of *saptak* is of minimum two *shruties.* If the sound is less than of two shruties then it can not become *swar.*
From *dwitiy sarana* we came to know the *shrutis* of *Gandhar* and *Nishd*
Tritiya sarana:-
Again the *swar* of *chal veena* are lowered by one *shruti*, *Dhaivat* and *Rishabh* will match *Pancham* and *Shadja* of *achal veena*. All *swar* of

Achal veena are high by three *shrutis* compared to *chal veena.* This proved that *Dhavat* and *Rishabh* has three *shruties* each.

Shree Lalit kishor Sinh has clarified the measure of third *shruti* is one *Laghu Ardh swar.* That is 25/24 or 18 Severts. Acharya Bruhspati has called it *'Upmahati shruti'.*

Chaturth sarana:-

In this *sarana* again the *swaras* of *chal veena* are lowered by one *shruti.* Then *Pancham, Madhyam,* and *Shadja* of *chal veena* will match *Madhyam, Gandhar,* and *Nishad* of *achalveena.* Now in this *sarana* the *swaras* of *achal veena* are higher by 4 *shruties*, therefore *Pancham, Madhyam,* and *Shadja* are or 4 *shruties.*

So *Gandhar* and Nishad are of two shrutis each that is total 4 shruties. *Dhaivat* and *Rishabh* are of 3 *shruties* each. that is total 6 shutis. *Pancham, Madhyam,* and *Shadja* are of 4 *shruties* each that is total 12 shruties. It is proved from 4 *sarana* that in *saptak* there are 22 *shruties.*

Prof. Lalit Kishor Sinh explained that in *chaturth sarana, Shadja, Madhyam,* and *Pancham* of *chalveena matched* with *Nishad, Gandhar* and *Madhyam* of *achalveena*, therefore 4 *shruties* is equivalant with comma *(Praman shruti)*

From the experiment of 4 *saranas* it is clear that all *swaras* of *saptak* are divided in 3 classes. Abhinav Gupta says Chatushrutik swar shadja, *Madhyam* and *Pancham* are *Udatta,* measure tone or *Guru swar.*

The measure of *Udatta* or *Guru swar* obtained from 4 *saranas* is as follows:-

comma or *Praman shruti* obtained from *pratham sarana* =81/80

Lima or *Mahati shruti* obtained from *dwitiya sarana* = 256/243

Laghu ardh swar or *Upmahati shruti* obtained from *tritiya sarana* = 25/24

Comma or *Praman shruti* obtained from *chaturth sarana* = 81/80

Therefore *chatushrutik swar* (having 4 *shruties sa ma pa* = 81/80 x 256/243x 25/24 x 81/80 = 9/8 or as per Severts *chatushrutik swar* comma *(Praman shruti*) + Lima (*Mahati shruti) + Laghu Ardha swar (Upmahati shruti)* + Comma *(Praman shruti)*

5 +23+18+5 = 51 Severt

Trishrutik swar or minor tone (*Laghu swar)* or *swarit*

Comma + Lima + *Laghu ardh swar*

5 + 23 + 18 = 46 or 81/80 x 256/243 x 25/24 =10/9

Dwishrutik swar Anudatta or semitone or *Laghu Ardha swar* is

Comma Lima = 81/80 x 256/243 = 16/15

or as per severt 5 + 23 = 28

In Bharat experiment of *chatusarana* at a time only one *sarana* can be done on *chal veena.* Acharya Sharangadeo has used *shruti veena* to prove there are 22 *shrutis* in one *saptak.* Acharya Bruhspati has used *Shruti Darpan* to prove *4 saranas* and *22 shruties* in one *saptak.* Dr Lalmani Mishra prepared *shrutiveena* . Both *veenas* are useful for 4 *sarana* experiment. *(Bharatiya Sangitka Itihas ; by Thakur Jaideo Singh,pg329 to 335)*

Dr Vidyadhar Oke has prepared 22 shruties harmonium by using Bharat muni's *Praman shruti, Mahati shruti* and *Upmahati shruti* obtained by *chatusarana* experiment

Lima or *Mahati shruti* 256/243 = 1.05349. It is called *Purna shruti.*

Laghu Ardha swar or *Upmahati shruti* = 25/24 = 1.04166. It is called *Nyun shruti.*

Comma or *Praman shruti* = 81/80 = 1.0125 From these ratios frequencies of 22 *shruties* can be found out.

Table shows 3 Principle Adjacent ratios for 22 Shrutis

These ratios explain the terms used by Bharatmuni for these ratios as shown below.

Adjacent Ratio 1 = 256/243 = 1.053497942 'Poorna Shruti'
Adjacent Ratio 2 = 25/24 = 1.041666666 'Nyuna Shruti'
Adjacent Ratio = 81/80 = 1.012500000 'Pramana Shruti'

Shruti 1 -	Shadja	Sa		261.6255528	
			x	1.053497942	**(Ratio 1)**
Shruti 2 -	Lower Komal Rishabh	r1		275.6219814	
			x	1.012500000	**(Ratio 3)**
Shruti 3 -	Komal Rishabh	r		279.0672562	
			x	1.041666666	**(Ratio 2)**
Shruti 4 -	Lower Shuddha Rishabh	R1		290.6950583	

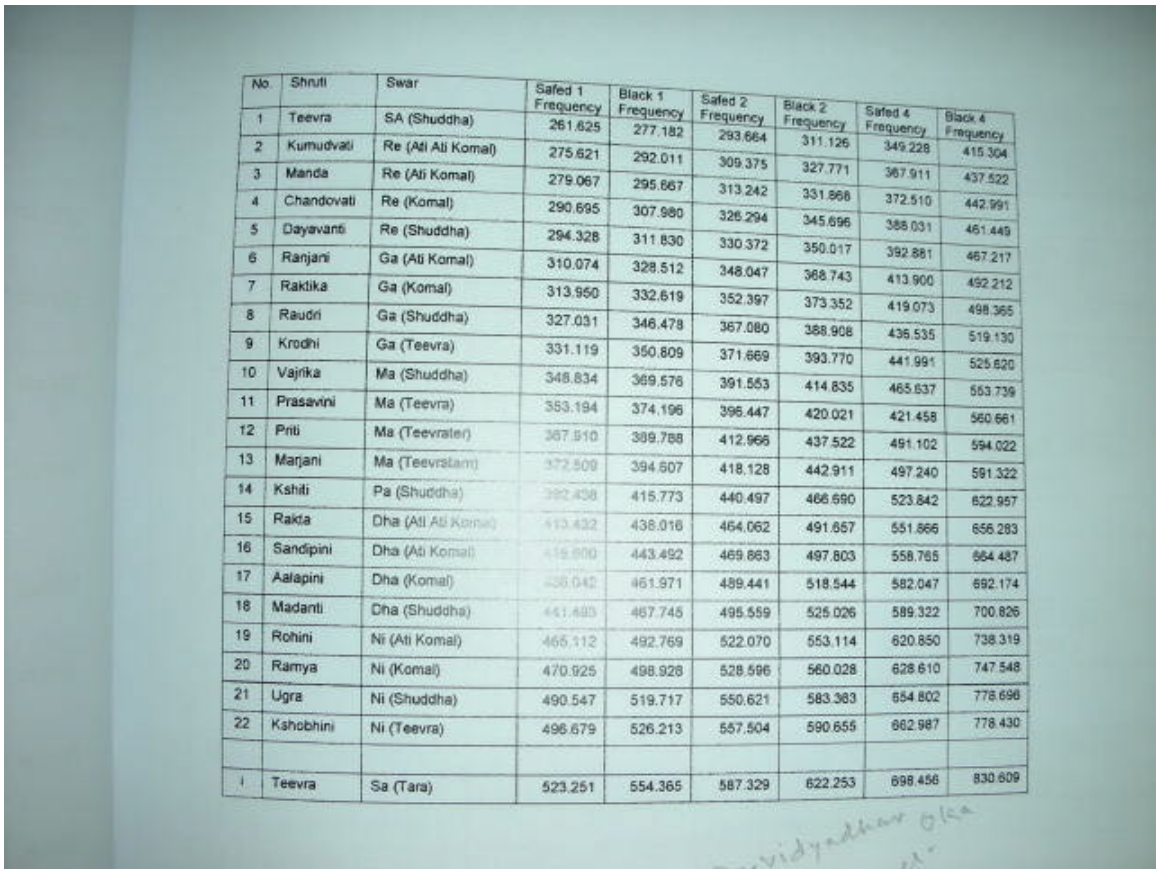
Further, the same Chain of Ratios occurring in the Code given below sequentially generates all 22 Shrutis.

The Code of Chain of Adjacent Ratio is,
1323,1323,1323,1
1323,1323,1

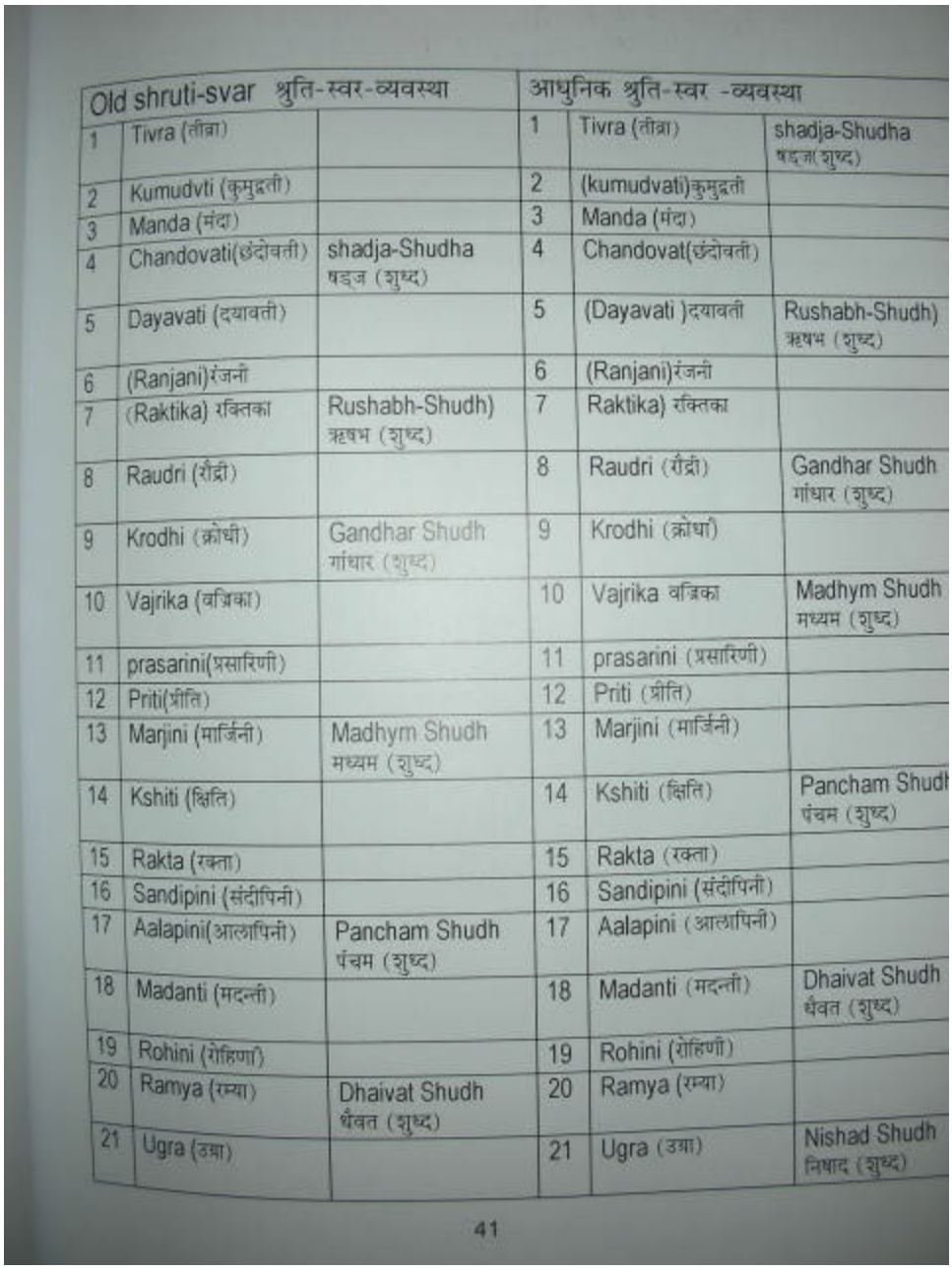
Table shows the working of the Code of Adjacent ratios

Shruti 1 -	Shadja	S		261.6255528		taken as 1.000
	(Ratio 1)		x	1.053497942		
Shruti 2 -	Ati-Komal Rishabh	r1		275.6219814	=	1.053497942
	(Ratio 3)		x	1.012500000		
Shruti 3 -	Komal Rishabh	r2		279.0672562	=	1.066666666
	(Ratio 2)		x	1.041666666		
Shruti 4 -	Shuddha Rishabh	R1		290.6950583	=	1.111111110
	(Ratio 3)		x	1.012500000		
Shruti 5 -	Teevra Rishabh	R2		294.3287466	=	1.124999999
	(Ratio 1)		x	1.053497942		
Shruti 6 -	Ati-Komal Gandhar	g1		310.0747288	=	1.185185184
	(Ratio 3)		x	1.012500000		
Shruti 7 -	Komal Gandhar	g2		313.9506629	=	1.199999998
	(Ratio 2)		x	1.041666666		

Shruti 8 -	Shuddha Gandhar (Ratio 3)	G1 x	327.0319403 1.012500000	=	1.249999997
Shruti 9 -	Teevra Gandhar (Ratio 1)	G2 x	331.1198396 1.053497942	=	1.265624997
Shruti 10 -	Madhyam (Ratio 3)	M1 x	348.8340695 1.012500000	=	1.333333330
Shruti 11 -	Ek-Shruti Madhyam (Ratio 2)	M2 x	353.1944954 1.416666666	=	1.349999997
Shruti 12 -	Teevra Madhyam (Ratio 3)	m1 x	367.9109325 1.012500000	=	1.406249996
Shruti 13 -	Teevratama Madhyam (Ratio 1)	m2 x	372.5098191 1.053497942	=	1.423828121
Shruti 14 -	Pancham (Ratio 1)	P x	392.4383278 1.053497942	=	1.499999995
Shruti 15 -	Ati-Komal Dhaivat (Ratio 3)	d1 x	413.4329707 1.012500000	=	1.580246908
Shruti 16 -	Komal Dhaivat (Ratio 2)	d2 x	418.6008829 1.041666666	=	1.599999994
Shruti 17 -	Shuddha Dhaivat (Ratio 3)	D1 x	436.0425860 1.012500000	=	1.666666659
Shruti 18 -	Teevra Dhaivat (Ratio 1)	D2 x	441.4931183 1.053497942	=	1.687499993
Shruti 19 -	Ati-Komal Nishad (Ratio 3)	n1 x	465.1120916 1.012500000	=	1.777777769
Shruti 20 -	Komal Nishad (Ratio 2)	n2 x	470.9259927 1.041666666	=	1.799999991
Shruti 21 -	Shuddha Nishad (Ratio 3)	N1 x	490.5479088 1.012500000	=	1.874999990
Shruti 22 -	Teevra Nishad (Ratio 1)	N2 x	496.6797576 1.053497942	=	1.898437490
Shruti 1 -	Upper Shadja	S'	523.2511025	=	1.999999988 i. e. = 2000



No.	Shruti	Swar	Safed 1 Frequency	Black 1 Frequency	Safed 2 Frequency	Black 2 Frequency	Safed 4 Frequency	Black 4 Frequency
1	Teevra	SA (Shuddha)	261.625	277.182	293.664	311.126	349.228	415.304
2	Kumudvati	Re (Ati Ati Komal)	275.621	292.011	309.375	327.771	367.911	437.522
3	Manda	Re (Ati Komal)	279.067	295.667	313.242	331.868	372.510	442.991
4	Chandovati	Re (Komal)	290.695	307.980	326.294	345.696	388.031	461.449
5	Dayavanti	Re (Shuddha)	294.328	311.830	330.372	350.017	392.881	467.217
6	Ranjani	Ga (Ati Komal)	310.074	328.512	348.047	368.743	413.900	492.212
7	Raktika	Ga (Komal)	313.950	332.619	352.397	373.352	419.073	498.365
8	Raudri	Ga (Shuddha)	327.031	346.478	367.080	388.908	436.535	519.130
9	Krodhi	Ga (Teevra)	331.119	350.809	371.669	393.770	441.991	525.620
10	Vajrika	Ma (Shuddha)	348.834	369.576	391.553	414.835	465.637	553.739
11	Prasavini	Ma (Teevra)	353.194	374.196	396.447	420.021	421.458	560.661
12	Priti	Ma (Teevrater)	367.510	389.788	412.966	437.522	491.102	594.022
13	Marjani	Ma (Teevratam)	372.509	394.607	418.128	442.911	497.240	591.322
14	Kshiti	Pa (Shuddha)	392.438	415.773	440.497	466.690	523.842	622.957
15	Rakta	Dha (Ati Ati Komal)	413.432	438.016	464.062	491.657	551.866	656.283
16	Sandipini	Dha (Ati Komal)	418.600	443.492	469.863	497.803	558.765	664.487
17	Aalapini	Dha (Komal)	436.042	461.971	489.441	518.544	582.047	692.174
18	Madanti	Dha (Shuddha)	441.493	467.745	495.559	525.026	589.322	700.826
19	Rohini	Ni (Ati Komal)	465.112	492.769	522.070	553.114	620.850	738.319
20	Ramya	Ni (Komal)	470.925	498.928	528.596	560.028	628.610	747.548
21	Ugra	Ni (Shuddha)	490.547	519.717	550.621	583.383	654.802	778.698
22	Kshobhini	Ni (Teevra)	496.679	526.213	557.504	590.655	662.987	778.430
1	Teevra	Sa (Tara)	523.251	554.365	587.329	622.253	698.456	830.609



Old shruti-svar श्रुति-स्वर-व्यवस्था			आधुनिक श्रुति-स्वर -व्यवस्था		
1	Tivra (तीव्रा)		1	Tivra (तीव्रा)	shadja-Shudha षड्ज (शुध्द)
2	Kumudvti (कुमुद्वती)		2	(kumudvati)कुमुद्वती	
3	Manda (मंदा)		3	Manda (मंदा)	
4	Chandovati(छंदोवती)	shadja-Shudha षड्ज (शुध्द)	4	Chandovat(छंदोवती)	
5	Dayavati (दयावती)		5	(Dayavati)दयावती	Rushabh-Shudh) ऋषभ (शुध्द)
6	(Ranjani)रंजनी		6	(Ranjani)रंजनी	
7	(Raktika) रक्तिका	Rushabh-Shudh) ऋषभ (शुध्द)	7	Raktika) रक्तिका	
8	Raudri (रौद्री)		8	Raudri (रौद्री)	Gandhar Shudh गांधार (शुध्द)
9	Krodhi (क्रोधी)	Gandhar Shudh गांधार (शुध्द)	9	Krodhi (क्रोधी)	
10	Vajrika (वज्रिका)		10	Vajrika वज्रिका	Madhym Shudh मध्यम (शुध्द)
11	prasarini(प्रसारिणी)		11	prasarini (प्रसारिणी)	
12	Priti(प्रीति)		12	Priti (प्रीति)	
13	Marjini (मार्जिनी)	Madhym Shudh मध्यम (शुध्द)	13	Marjini (मार्जिनी)	
14	Kshiti (क्षिति)		14	Kshiti (क्षिति)	Pancham Shudh पंचम (शुध्द)
15	Rakta (रक्ता)		15	Rakta (रक्ता)	
16	Sandipini (संदीपिनी)		16	Sandipini (संदीपिनी)	
17	Aalapini(आलापिनी)	Pancham Shudh पंचम (शुध्द)	17	Aalapini (आलापिनी)	
18	Madanti (मदन्ती)		18	Madanti (मदन्ती)	Dhaivat Shudh धैवत (शुध्द)
19	Rohini (रोहिणी)		19	Rohini (रोहिणी)	
20	Ramya (रम्या)	Dhaivat Shudh धैवत (शुध्द)	20	Ramya (रम्या)	
21	Ugra (उग्रा)		21	Ugra (उग्रा)	Nishad Shudh निषाद (शुध्द)

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22	Kshobhini (क्षोभिणी)	निषाद (शुध्द)	22	Kshobhini (क्षोभिणी)	
1	Tivra (तीव्रा)		1	Tivra (तीव्रा)	shadja-Shudha षड्ज (शुध्द)
2	Kumudvti (कुमुद्वती)		2	Kumudvti (कुमुद्वती)	
3	Manda (मंदा)		3	Manda (मंदा)	
4	Chandovati (छंदोवती)	shadja-Shudha षड्ज (शुध्द)	4	Chandovati (छंदोवती)	

Chapter 3

SWAR

In North Indian Clssical music the SWAR or NAD means sound useful for music or musical sound. Sharangdeva has definded SWAR in Sangit Ratnakar 'mJeleeˆ jÀeÙeeleˆ ßeeleeÛeòeˆ meˆ mJejˆ GÛÙeleˆ' Mahabhashya author Patanjali has defined SWAR as follows(mJejˆ · mJe ± j, FLeˆ mJe ·mJeÙeˆ Jeˆ jˆ · jepevleˆ; cnCeveˆ 'mJeÙeˆ jepevleˆ' Feleˆ mJejˆ:)

Work on Indian music lay emphasis on the resonance character of SWRA(the resonanse is Anurana) and it's aesthetics effect. When we strike a string strung to a certain pitch a sound is produced but it does not stop there. A continuous series of sound is heard as a result of the stroke. Then there is a resonance (Anuran). This continuous series of sound of the same pitch which is melodious and gives aesthetic joy is called SWAR in Indian music.

The sound first produced and heard is mere SHRUTI while the the continuous sound of same pitch or a resonance marks it off as SWAR or tone. Science defines tone from the physical point of view, but Indian music describes it from the point of view of an Art.

The word SWAR is composed of two letters, SWA + RA. The letter SWA stands for the word swayam that is by itself and RA stands for rajate or ranjayati that is shines or delights. SWAR or Tone (NAD) is that which shines or delights by itself without any extraneous aid. In ' Rigved ', SWAR is described in three different ways. 1)UDATTA, 2) ANUDATTA, 3)SWARIT. Ruchas in Rigved were sung in three different ways. A little change in these three ways of SWAR makes different meaning.

Bhanuji Dixit has defined SWAR in Amarkosh 'mJeÙevleSLee SeYe: As per this defination SWAR explains the meaning of Ruchas. In some music books SWAR is named as YAMA –useful note for music. YAMA in defined in two different ways. 1) eveÙecÙevleSLee SeYe: means with the help of SWAR meaning of Ruchas is controlled. 2) 'eveÙecÙevle OJeveÙe: SeYe: Fele Ùecee: means sound useful for music.

The defination of SWAR as musical sound is 'mJele: jpeÙeele Fele mJej:' that is SWAR delights itself. In vedic period it was definite that the No. of SWAR or YAMA were seven. In vedas the meaning of SWAR was given as 'Goeòeeoe mJejeÛeejCe eJeeOe' In limited sense they are three. UDATTA,ANUDATTA and SWARIT. But in larger sence / in detailed, there are seven SWARAS. In Mahabhashya (1:2:33), seven SWARA are described as olle 'mehle mJeje YeJeevle Goeòe, Goeòelej:, DeveOeòe: DeveOeòelej:, mJeejle:, mJeejle Ùe Goeòe: meevÙeve eJeeMe° Skeâßeele mehlece:' This means seven SWARAS are UDATTA,UDATT TAR ,ANUDATTA, ANUDATTATAR, SVARIT. In the beginning of SWARIT, there exists UDDATTA., which is different from second UDATTA and seventh SWAR is EAKSHRUTI.

Before the vedic period the names of seven SWARAS were Krustha (Madhyama), Pratham (Gandhara), Dwitiya (Rishabha), Tritiya (Shadja), Chaturtha(Nishada), Mandra(Dhaivata), and Atisvarya or Atiswar(Panchama).

Three SWARA, UDDATTA, ANUDATTA and SVARIT from Rigved were developed in seven SWARAs by the time of Samved. In old Mandukiya shikshya, the following statement is given. 'mehle mejevle ieeÙele ~ meeceeYe: meeceie yeOe:~~

Inclusion of seven SWARS in three SWARA of Rigved in Paniniya Shiksha as follows: 'Goeòe eve<eeo ieeOeej, Deveoeòe $e+<eeo OeJele:~

mJeejle ØeYeJeenle <e[pe, ceOÙece: heÛece: ~~

This means the seven SWARAS are devided in three SWARAS of Rigved as follows

1) UDATTA:- Nishad (Ni), Gandhar (Ga)
2) ANUDATTA:- Rishabh (Re), Dhaivat (Dh)
3) SVARIT:- Shadja (Sa), Madhyam (Ma), Pancham (Pa)

In grammer SWAR is defined as sound which is produced without the external aid of any Varna. The seven SWARAS are 1)De, 2)F, 3)G, 4)$e+, 5)è, 6)S, 7)Dee

Dee, F, T are extended notes of seven SWARAS.

When SWAR is promoted by –

One shruti is called Tivra

Two shruties is called Tivratar

Three shruties is called Tivratam

Four Shruties is called Atitivratam

When SWAR is lowered by one Shruti it is called Komal. When it is loweded by-

two shruties it is called Purva or atikomal.

The behavior of SWARA of being komal or tivra is because shuddha SWAR takes the shruti of previous SWARA or next SWARA. When one SWAR takes the shruti of other SWAR it is called SADHARANYA of both SWARAS. Old Pandit used to say SADHARAN Re (Rishabh) is

called tivra Re. SADHARAN Ga (Gandhar) is called komal Ga, similarly tivratam Ga is called MRIDU (ಮೃ)Ma. Sadharan Ma and antar Ma are called tivra Ma and tivrater Ma.

tivratar ma is called MRIDU Pa.

Sadharan, katali and Kaushik Ni SWAR is tivra Ni, tivratar Ni, and tivratam Ni.

Pt. Ahobal says if two different swaras have the same shruties, they should not be considered different .

Musicologists say the swar which is used more in Ragas is called 'Vadi'(main swar). Vadi swar is also called the king of the swaras.

Bharatmuni also says that if the distance between the two swaras is either 9 or 13 shruties, they are called 'sanvadi swaras'. In Shadjagram therefore

Shadja – Pancham 13 shrutis

Rushabh – Dhaivat 13 shrutis

Gandhar – Nishad 13 shruties

Shadja – Madhyam 9 shrutis

In Shadja gram every swar has got sanvadi swar. Shadja has Madhyam and Pancham sanvadi swar. In Shadja gram Pancham is reduced by one shruti then it makes sanvad with rishabh. It is called Madhyam gram.

In Madhyam gram except Shadja-Pancham all other swaras have sanvadi swar like Shadga gram.

Shadja – Madhyam 9 shrutis

Rishabh – Pancham 9 shrutis

Rishabh – Dhaivat 13 shrutis

Gandhar – Nishad 13 shruties

The swar which is not either Vadi, Sanvadi or Vivadi in raga is called 'Anuvadi'. The swar because of which the melody is lost is called 'Vivadi'.

'Vadi' swar is called the king, Sanvadi swar is called priminister, Anuvadi swar is called peon. Vivadi swar is called like enemy.

KUL (Family) of swara:-

Shadja, Madhyam and Gandhar are from Devata (God) Kul.

Pancham is from Pitru Kul

Rishabh and Dhaivat are from Rushi Kul (Saint)

JATI (cast) of swara:-

Shadja, Madhyam and Pancham are from Brahmin jati

Rishabh and Dhaivat are from Kshatriy jati (Fighter)

Gandhar and Nishad are from Vaishya jati (traiders)

Vikrit swar are from Shrudra jati(lower class)

Colours of Swars:-

Colour of Shadja is like Lotus

Colour of Rishabh is like Pinjar (perticular type of red)

Colour of Gandhar is like Suvarna (Gold)

Colour of Madhyam is like Kund flower

Colour of Pancham is like Shyam varna (Gray)

Colour of Dhaivat is like peet varna (Yellow)

Colour of Nishad is like Chitra varna

Birth of Swara:-

The seven swaras are coming from following seven islands

Jumbu, Shak, Kush, Krounch, Shalmali, Shveta, and Pushkar

The following Gods saw them first.

Agni, Brahma, Chandra, Vishnu, Narad, Tumbaru,and Kuber.

God of the swara:-

The Gods of the seven swaras are as follows

Agni, Brahmadeo, Saraswati, Mahadeo, Vishnu, Ganesh,and Surya

Chand of swaras:- (Various patterns)

Anushtubh, Gayatri, Trishtup, Jagati, Brihati, Pankti, and Ushnik

Rasa of swara:- (The different feelings which swaras creat)

Shadja and Madhyam are responsible for Hasya and Shringar rasa

Dhaivat and Nishad are also responsible for Hasya and Shringar

Pancham is responsible for Bibhatsa, Karun and Bhayanak rasa.

Rishabh is responsible for Shrigar rasa.

Gandhar is responsible for Hasya rasa

Tivra swaras are ideal for Veer, Adbhut and Raudra rasa. Tivratar swaras are useful for Hasya rasa. Tivratar Madhyam is good for Shringar rasa, Tivratam swara are good for Shringar rasa. and shudha Madhyam is good for Hasya rasa.

Pandits have discribed the various properties of swaras as mentioned above.

Pt. Ramamatya

Pt Ramamatya in his book 'Swaramel Kalanidhi' has accepted the definition and source of *NAD, SHRUTI, SWAR* as per Sharangadeo. He says about No. of swaras that shruti becomes swara it is due to previous shruti. So according to him shuddha swaras are seven and vikrut swaras are also seven that is 14 swaras are usefull for music. When shudh swar leaves *Adharshruti* (shruti on which shuddha swar is fixed) it becomes Vikrut.

Pt Matang has described about vyutpatti (How the names of swars are given) of swaras.

Shadja :- It creats six swaras or it is created from six swaras or from the six different parts of body.

The swara from which six swaras are created or developed or gives birth or delights them is called *SHADJA.,* is prooved by grammer (<eš ± pe (peve Oeeleheemeve). or it is created or developed or delighted from six swaras are called SHADJA. Or which is created from six different parts of body such as Nasika (nose), Kanth (vocal cord), Ura (Chest) Talu (Head), Jivha (toung) and Dant (dental) is called SHADJA.

Rishabh:- Compared to other swaras it touches the heart of listeners quickly therefore it is called Rishabh. or in the group of cow, bull looks great and beautiful, similarly in all other swaras Rishabh looks great. '$e+<e' means to go, word when joines 'DeYe' vowel, then it touches the heart quickly compared to other swaras. Therefore it is called Rishabh.

Gandhar:-

It is suitable for Gana (Music) Therefore it is called Gandhar In Sanskrut language iee Oeòe means ieevee lcekeâ JeeCee Oeejce keâjlee. (It becomes musical). 'Oe' means becomes. Therefore iee ± Oe means Gandhar ward is formed. ('iee' men

JeeÛee. Ùee MeyoeÛe iee n eÉleeÙeÛe SkeâJeÛevee ¤he neÙe.).or it is responsible for ieeOeJemeKe , therefore it is called Gandhar.

Madhyam:-

It is a middle note among the seven notes. therefore it is called Madhyam.

Pancham:-

It measures the size or expansion of other six notes.Therefore it is called Pancham. It is on fifth place in seven notes.

Dhaivat:-

In Sanskrit Oee' means knowledge. One who has a knowledge OeeJeeve (Oe±Jele), therefore it is Dhaivat. It is on sixth place in saptak indicates forehead keâheeU, therefore it is Dhaivat. It is difficult to understand Dhaivat for people having less knowledge, but people having good knowledge can understand the nature of Dhaivat. Therefore it is called Dhaivat.

Nishad:-

It is at seventh place in septak. and all other swaras end at this swara therefore it is called Nishad. In Sanskrit eve±meO (sit down), basic vovel therfore it is Nishad.

It should be easy to use in common practice therefore only first letters are considered that is Sa, Re, Ga, Ma, Pa, Dha, Ni .

IMPORTANCE of SWARA

Music, Painting, Sculpture, Architecture, Dramatics create the sensation in human body, like listening, seeing, and touching. The mediums of these arts are swar, colour, line, metal, and such solid

material, words and conversation. Except music the purpose of all other arts is human life, but the medium and purpose of art Music is swar.

For arts other than Music experience of life is source of expression. For the art Music the world of music is source of expression

The purpose of art Music is free from life, and purpose of life. Swar is soul of Music. The famous Music scholar B.S. Acharekar said Swar - Nad is a soul of Music therefore Music is a poem of swara. Pt. Kallinath said while listening to Music we forget all other things and we experience pure enjoyment. Pt Balkrishnabuva Kapilashwari had mentioned in his book 'Shruti Darshan' the importance of Ahat nad that due to this nad mind, becomes steady and peaceful . Mind and thinking are engrossed in Ahat nad.

About the purpose of Music there are two opinions in Sanskrit litereture 1) Music gives you enjoyment 2) Music is a medium through which you can achive hejceÕej, Oece, DeLe, keâece, DeeeCe cee#e n he®<eeLe!

The great music director Mr Oran Kopland has mentioned in his book 'Music and Imagination' that in the experience of the art Music, imagination has lot of importance. The art Music being beyond imagination, without any shape (Decele), and free (ceòeá). Therefore imagination has lot of scope. The medium of art Music being swar, it is different than medium of other arts.

Chapter 4

STHAN (Place) of SWARA

In Indian music there are 12 swaras. Sa, Re, Ga, Ma, Pa, Dha, Ni. **(**mee, j, ie, ce, he, Oe, eve**)** are 7 Shudhdha swaras (pure note), Re, Ga, Dha, Ni (j, ie Oe eve)4 komal swar (vikrut swar), one or two shruti less, and tivra ma (**ce-)**one or two shruti higher. These 12 swaras are devided in 22 shruties.

Pt Ahobal has mentioned in his book 'Sangit Parijat Praveshika', seven shudhdha swaras and 22 vkrut swaras (either one or two shruties higher or lower) total 29 swaras devided in 22 shrutis.

Ahobal' table

22 ßeele Je lÙeeJej Derneyeueve ceeÙueue MeOo Je eJekeâle mJej

8	Raudri jeõe		Komal Ga	Tivra lee>e	
No	**Name of Shruti**	**Shuddh swar**	**Komal** keâeceue Ie **Vikruti**	**Tivra vikruti**	**Remark**
9	Krodhi >eâeOee	Ga ie		Tivratar Re lee>elej	Re will not
1	Tivra lee>ee			Tivra ni lee>e vee je	go further
2	Kumudati keâceolee			Tivratar ni lee>elej vee	
10	Vajrika Jee»ekeâe			Tivra Ga lee>e ie	
3	Manda ceOe			Tivratam ni lee>elece	
11	Prasarini ØemeeejCee			Tivratar Ga lee>elej vee ie	
4	ChandovatiÚoeJelee	Sa mee			Achal swar
12	Priti Øeelee			Tivratam ga lee>elece	
5	Dayavati oÙeeJelee		Purva e heJe je	ie	
6	Ranjani jpevee		Komal Re		
13	Marjani ceepevee	Ma ce	keâeceue je	Atitivratam ga Delee lee>elece ie	limit of Gga
7	Raktika jeÒeâkeâe	Re je	Purva Ga heJe		
14	EKshiti e#elee		ie	Tivra ma lee>e ce	
15	Rakta jkeälee			Tivratar ma lee>elej	

				ce	
16	Sandipani meoeehevee			Tivratar ma lee›elece ce	
17	Alapini Deueeehevee	Pa He			Achal swar
18	Mandati ceolee		Purva Dha heJe Oe		
19	Rohini jeenCee		Komal Dha keâeceue Oe		
20	Ramya jcÙee	Dha Oe	Puv Ni heJe vee		
21	Ugra G«ee		Komal Ni keâeceue vee	Tivra Dha lee›e Oe	
22	Kshobhini #eeeYeCee	Ni vee		Tivratar Dha lee›elej Oe	
22		7	8	14	swar 29

Pt Ramamatya has mentioned in his book 'Swarmel Kalanidhi', that there are 7 shudhdha swaras, and 7 vikrut swaras, total 14 swaras has been devided in 22 shrutis. He has considered Shadja and Pancham also Chal (changable) swaras.

Bharatiya sangeet is not only limited to 12 swaras and their particular sthan on perticular shruti. The sthan of either shudhdha or komal swaras depend on different harmonic permutations and combinations of swaras, Gamak type singing some factors like rasa, bhav, and emotion , type (jati) of shruti and consonance (sanvaditva). In Bhartiya sangieet any combination of swaras should be proper for exploiting melody of raga. The speciality of

Bharatiya sangeet is in it's creativity (srujanshilata) which will enhance the beauty and melody of raga.

Pt Ahobal has also said in his book 'Sangeet Parijat Praveshika' that due to different application of a swara in different ragas, different sthan (place) of the same swara in different ragas is observed. He further says that it is important to know the exact structure of raga,,

In Bhartiya sangeet the sthan of swara in raga is dependent on following important considerations

1) The consonance of swaras:- Our Bharatiya Sangeet is based swaragata shruties which provide samvad or consonance.In Bhartiya sangeet the sthan of all the swaras in Raga is based on Shadja-Pancham bhava, Shadja-Madhyam bhava and Shadja-Gandhar bhava.

swar saptak Sa, Re, Ga, Ma, Pa, Dha, Ni is naturally developed. This is true in weastern music also. only it is called 'Octave'. The existance of music is right from the existance of human being. and the development or progress of music is because of expressions of musical feelings by human being. In Chinese and Japanis music there are only 5 swaras. i.e. Sa, Re, Ga, Pa, Dha. It is called swar-panchak. and pentatonic scale. Bharatiy swar saptak is called natural scale. When the vibrations of a string with tension is produced gives the original / basic vibration along with second, third,, fourth and fifth harmonics. This is proved scientifically, which was recognised by our old music scholars like Bharatmuni, Narad, Manduk, and Abhinav Gupta etc. by just ear.

Now to established our swar saptak scientifically. Let us assume the vibrations of particular string with tension is 240 vib/sec. Let us call it Sa of Madhya saptak. Along with these vibrations 2x 240, 3x240, 4x240 and 5x240 harmonics are also produced. The basic 240 vib / sec are mixed in

such way with 480 vibrations per second that the nad produced is most melodious and very difficult to differentiate one from other. It is called Shadja-Shadja bhav. The ratio between Madhya saptak Sa and Tar saptak sa is 1:2 . Madhya saptak is from 240 vib/sec to 480 vib /sec. Now let us consider three times vibration of basic Madhya saptak sa i.e. 720vib /sec. which is beyond the limits of Madhya saptak i.e. it is in tar saptak. If we want to include this in Madhya saptak we do it by taking half of 720 vib/ sec i.e. 360vib/sec. which is within the range of Madhya saptak. It is called Pancham. and the ratio of Pancham (360vib/sec). with basic Shadja of Madhya saptak (240vib/sec) which is 2:3. These two swaras also have melodious consonance which is called Shadja-Pancham bhav. One more swar with Shadja-Pancham bhav with Tar Shadja which can be included in Madhya saptak is the swar with 320vib/sec. which is called Madhyam. It is 2:3 with Tar Saptak shadja. The ratio of madhyam (320vib/sec) with basic Shadja (240 vib/sec) of madhya saptak) is 3:4. It is called Shadja-Madhyam bhav.

The swar with 4times vibrations of basic shadja of madhya saptak is 960vib/sec. It is called atitar saptak shadja. The swar with 5 times vibrations of basic Shadja of Madhya saptak is 1200vib/sec. It can be called atiati tar Shadja.

Now this 1200vib/sec swar if we bring it to one lower saptak means the vibrations will be reduced to 600vib/sec. Even these vibrations are also beyond the range of Madhya saptak. Now if we want bring this to Madhya saptak then the vibrations will be reduced to half i.e. 300 vib/sec. This swar is within the limits of Madhya saptak. This is the swar which we hear from Kharja string of tanpura which is made out of brass. It is called swayanbhu

(mJeÙeYe ieeOeej)Gandhar. In musical language it is called Shadja-Gandhar bhav and as far as melody is concerned it is next to Shadja-Pancham bhav.

In natural saptak we now got swar:- Sa, Ga, Ma, Pa, Sa^{I}

vib/sec:- 240 300 320 360 480

From the above swaras we come to know that the ratio between Pa (360vib/sec) and Tar Shadja (480vib/sec) is 3:4. which is largest. The ratio between Ga (300vib/sec) and Ma (320vib/sec) is minimum i.e. 15:16 . The ratio between Madhya saptak Shadja (240 vib/sec) and ga (300vib/sec) is 4:5. And ratio between Ma(320vib/sec)and Pa (360 vib/sec) is 8:9.

To complete the saptak we have to find out three more swaras which should be melodious and forming consonance with other swaras

Any combination of swaras should have aesthetic sense and should be melodious. Shadja-Pancham bhav being important on the basis of that remaining three swaras can be found out.

Gandhar (300vib/sec) will have Shadja-Pancham bhav in ratio 2:3 with 450vib/sec. This is called 'Ni' in our natural scale. This 'Ni' swar by Shadja-Gandhar bhav makes consonance with Pa.

In our natural scale Shadja and Pancham are Achal swar. Pancham with 360vib/sec will make consonance in 2:3 proportion with 540 vib/sec. That is beyond the limit of Madhya saptak. Therefore if we have to bring it in Madhya saptak we will have to make the vibration half of 540vib/sec i.e. 270 vib/sec. This is Rrishabh-'re'.

We have established following swaras in natural scale.

Swar :- Sa Re Ga Ma Pa Ni Sa

vib/sec 240 270 300 320 360 450 480

We have to establish the remaining Dha of Madhya saptak in natural scale. Dha by Shadja-Pancham bhava makes consonance with Rishabh.

Therefore Rishabh (270vib/sec) will have consonance with the swar having 405 vib/sec. It is called Dha. But Dha makes the consonance by Shadja-Madhyam bhav with Gandhar and by Shadja – Gandhar bhav with Madhyam. Then Dha will have 400vib/sec and 405 vib/sec so the final natural swara saptak will be..

Swara:-	Sa	Re	Ga	Ma	Pa	Dha	Ni	Sa
vib/sec	240	270	300	320	360	400	450	405

The use of consonance is as per the expectation of rasa, bhava, and melody. Any harmonic combination which will be suitable for expected rasa, bhava and melody of raga is used. . True consonance exist between Shadja-Pancham bhav and Shadja- Gandhar bhav. The Vadi – Sanvadi pairs of swaras are natural consonance only and Shadja-Madhyam bhava also.

For example both Todi and Multani have Sa(), Re (Komal) (), Ga (Komal(),

Ma (tivra)(), Pa (), Dha(komal)(), Ni ()

Swaras of raga Todi Shadja, Komal Rishabh, Komal Gandhar, Tivra Madhyam, Pancham, Komal Dhaivat, and Nishad

Vadi swar:- Komal Dhaivat d

Samvadi swar :- Komal Gandhar g

All consonances will have to be with komal Dhaivat and Komal Gandhar. Traditionally Atikomal Gandhar (g1) is used.

g1(Atikomal Gandhar) makes a Shadja-Pancham bhava with Atikomal Dhaivat d1.

Atikomal Dhaivat d1 makes Shadja-Madhyam bhava with Komal Rishabh r1.

Komal Rishabh r1 makes Shadja-Madhyam bhava with Tivra Madhyam m1

Tivra Madhyam m1 makes Shadja-Madhyam bhav with Shudhdha Nishad N1

Shdja S and Pancham P are achal.

Raga Multani:- swaras of raga Multani shadja, Komal Rishabh, Komal Gandhar, Tivra Madhyam, Pancham, Komal Dhaivat and Nishad

Vadi swar:- Pancham P

Samvadi swar:- Shadja S

All consonances will have to be with Pancham P and Shadja. S

Pancham P makes a Shadja-Gandhar bhav with Shuddha Nishad N1

Komal Gandhar g2 makes Shadja-Gandhar bhav with Pamcham P

Komal Gandhar g2 makes Shadja-Pancham bhava with Komal Dhaivat d2

Shudhdha Nishad N1 makes Shadja – Pamcham bhava with Tivra Madhyam m1.

Tivra Madhyam m1 makes a Shadja-Madhyam bhava with Komal Rishabh r1

Shadja S and Pancham P are achal swaras

Both Marawa and Puriya have Shadja, Komal Rishabh, Gandhar, Tivra Madhyam, Shudhdha Dhaivat Shuddha Nishad

Rag Marawa:-

Swaras of raga Marawa are Shadja, Komal Rishabh, Shuddha Gandhar, Tivra Madhyam, shuddha Dhaivat, Shuddha Nishad

Vadi swar:- Komal Rishabh r

Samvadi swar:- shuddha Dhaivat D

All consonances will have to be with Komal Rishabh r and Shuddha Dhaivat D

Normally higher pitch veriety of Shuddha Dhaivat is used. hence D2 (Tivra dhaivat) makes Shadja –Pamcham bhava with Tivra Gandhar or higher pitch verity of Shuddha Gandhar hence G2.

Higher pitch variety of Shuddha Gandhar G2 makes a Shadja – Pancham bhava with Tivra Nishad or higher pitch veriety of Shuddha Nishad , hence N2

Higher pitch variety of Shuddha Daivat D2 makes Shadja – Gandhar bhava with Atikomal Rishabh , hence r1.

Atikomal Rishabh r1 makes Shadja-Pancham bhava with Tivra Madhyam or lower variety of Tivra Madhyam, hence m1.

Shadja comes as Achal swara

Raga Puriya :-

Swaras of raga puriya are Shadja, Komal Rishabh, Shuddha Gandhar, Tivra Madhyam, Shuddha Dhaivat and Shuddha Nishad.

Vadi swar:- Shuddhs Gandhar G

Samvadi swara:- Shuddhs Nishad N

All consonances will have to be with Shuddha Gandhar G and Shuddha Nishad N

Traditionally lower variety of Shuddha Gandhar is used hence G1

Lower variety of Shuddha Gandhar G1 makes a Shadja –Pancham bhava with lower pitch variety of Shuddha Nishad hence N1

Lower pitch variety of Shuddha Nishad N1 makes Shadja-Madhyam bhava with lower pitch variety of Shuddha Madhyam, hence m1

Lower pitch variety of Shuddha Madhyam m1 makes Shadja-Pancham bhava with Atikomal Rishabh, hence r1

Lower pitch variety of Shuddha Gandhar makes Shadja- Madhyam bhava with lower pitch variety of Shuddha Dhaivat, hence D1

Shadja comes as Achal swara.

Both Bhup and Deshakar have Shadja, Shuddha Rishabh, Shuddha Gandhar, Pancham and Shuddh Dhaivat as swaras.

Raga Bhoop:- Swaras of raga Bhoop are Shadja, Rishabh, Gandhar, Pancham and Dhaivat

Vadi swar:- Gandhar G

Samvadi swar :- Dhaivat D

All consonances will have to be with Gandhar G and Daivat D

Traditionally Shuddha Gandhar with lower pitch variety G1 is used. Shuddha Gandhar with lower pitch variety G1 makes Shadja-Madhyam bhava with lower pitch variety of Shuddha Dhaivat , hence D1

Lower pitch variety of Shuddha Dhaivat D1 makes makes Shadja-Madhyam bhav with lower pitch variety of Shuddha Rishabh, hence R1.

Shadja and Pancham come as Achal swaras.

Raga Deshkar:-

Swaras of raga Deshkar are Shadja, Rishabh, Gandhar Pancham and Dhaivat

Vadi swar:- Dhaivat D

Samvadi swar:- Gandhar G

All consonances will have to be with Dhaivat D and Gandhar G

Traditionally Tivra Dhaivat or higher pitch variety of Shuddha Dhaivat is used, hence D2

Tivra Dhaivat D2 makes Shadja-Pancham bhava with higher pitch variety of Shuddha Gandhar , hence G2

Tivra Dhaivat D2 makes Shadja-Madhyam bhava with Tivra Rishabh or higher pitch variety of Shuddha Rishabh , hence R2

Shadja and Pancham come as Achal swaras.

(Refer table showing working the code of adjacent ratios in chapter 2 SHRUTI)

2) Time theory of raga:- The intensity of sun rays affects the moods of human being and the harmonic combinations of swaras of raga, rasa, bhav and melody. It is therefore proper to sing raga using / having suitable harmonic combination of swaras as per time or Prahar, such as early morning, morning , noon, afternoon ,early evening, evening, night, mid night ect. It always gives pleasure to the singer and listener

3) The permutations and combinations of swaras in raga (swarsangati):- The combination of swara in Aroh and Avroha of raga fixes the sthan of perticular swara (place) . For example the swaras of raga Todi and Multani are same , Shadja, Komal Rishabh, Komal Gandhar, Tivra Madhyam, Komal Dhaivat and Nishad, but the combination of swaras in Aroh and Avroha being different, the sthan of swaras like Komal Gandhar, Komal Rishabh, Komal Dhaivat, and Tivra Madhyam is different.

4) Vadi and Samvadi swar:- If the swaras in two different ragas are same but Vadi and Samvadi swaras are different then also the sthan of swara changes. It is necessary to show the importance of Vadi and Samvadi swaras in raga and accordingly the combination of swars

while singing raga-alap bol-alap, gamak, tan, is sung. For example in raga Bhup, vadi swar is Gandhar and samvadi swar is Dhaivat. In raga Deshakar, vadi swar is Dhaivat and sanvadi swar is Gandhar.

5) Nyasa:- Settling on perticular swar while singing raga is Nyas. Nyas is responsible for the change in combination of swaras, Therefore the sthan of same swaras changes in different raga. For example Bhup and Deshkar have same swaras but in Bhup Nyas is on Gandhar and Rishabh, and In Deshkar the Nyas is on Pancham. Therefore the sthan of swara like shudhdha Dhaivat changes.

6)The structure (swarup) of raga:- How is the structure of raga?, how is the development of raga?(badhat), how raga is sung? i.e. in mandra saptak, madhya saptak or tar saptak, how is the mood of raga? what sort of rasa expected from raga?, distance of No. of shruties beween two swaras are also important factors in fixing the sthan (place)of swara.

7)The Bhav of raga:- The emotional expressions of raga decides the sthan of swara.

8)The words of Bandish:- When the letters of the word are placed on perticular swara then the poem is developed(geet). According to the meaning of the word the bandish should be sung. Then only expected bhav and rasa will be achieved. Whether the swara is meend type or oscillation type (andolit) or serious type or lovable type will be also important and decides the sthan of swara.

9)The personality of an artiste:- The sthan of swara in the raga also depends on the personality of an artiste. His vocal ability of expressions of raga. whether an artiste is using consonance principle properly the personality of a singer fixes the limits of consonance and

harmonic combination. the speciality of Bharatiya sangeet is in creativity to highlight the beauty of raga depends on personality of an artist. In Bhartiya sangeet resonance and asthetic scense is expected not just following.

There is basically no difference between shruti and swar because both are audible. In any raga out of 7 nadas which are fix on perticular shruti is swar . and all others are shruties. Komal, atikomal, tivra, tivratar are as per the sthan of the swara. Whether shudhdha swar takes shruti of the previous swar or next swar is vikrut. Bhartiya sangeet is sung by using shudhdha and vikrut swar. While singing raga komal, atikomal, tivra ect. should automatically come due to combination of swara and vocal expression. If the proper pronounciation is applied then the proper swar sthan –lower or higher- is acheived. If the swar is not placed on proper sthan by an artist it becomes out of tune.

10)The mental condition of an artiste :- The sthan of swara in raga depends on the mood of the artist. If the artist is in sad, mood, happy mood or angry mood or depressed mood, accordingly sthan of the same swara will differ.

11)Vocal chord of an artiste:- The sthan of swara depends on the artist's vocal chord. Therefore the sthan of particular swara will change from artist to artist.

12)Raganaga of raga :- Raganaga of raga is very important in deciding or fixing sthan of swara in particular raga. The base (adhar) of any raga depends on particular swar-sandarbh. Svayam raga is that whose arrangement of swara(swar-rachana) is independent. Whose bhav and rasa are specially expected . whose aroh, avroha, vadi-sanvadi,

rhasvatva-deerghatva , alpatva and bahutva is as per the rule. whose swaras of purvang has got definite relation with swaras of uttarang . The ragas in which swayanm ragas appeare effectively (chaya) are called raganga. For ex. Bhairav raga. Bhairav raga appears effectively in ragas kalingada , Bhairav anga guori, Shivmat bhairav, Ramkali, Ahir Bhairav...So they are called Bharavang ragas.

Bilaval **(**eyeueeJeue**)** :- Bilaval, Alhaiyya, Sarparada, Kukubh, Lchyasakha, Shukla, Yamani, Devgiri (eyeueeJeue, DeunÙee, mejhejoe, keâkeâYe, ueÛÚemeeKe, Mekeue, Ùecevee, oJeeieje,)

pepe, meeKeÙee

Kalyan (keâuÙeeCe**)** :- Kalyan, Shudhdha Kalyan, Yaman, Chandrakant, Tivra Kalyan, Pahadi, Hemkalyan, Jayatkalyan (keâuÙeeCe, MeOo keâuÙeeCe ekeâJee Yehe keâuÙeeCe, Ùeceve, ÛeõkeâevIe, Iee>e keâuÙeeCe, hene[e, ncekeâuÙeeCe, peÙeIekeâuÙeeCe)

Khamaj **(**Keceepe**)** :- Khamaj, Jhinjhoti, Tilang, Mand, Khanbavati (Keceepe, ePePeeše, eIeueie, cee[, KeyeeJeIee)

Kafi (keâeHeâe**)** :-Kafi, Sindhora, Anand Bhairavi (keâeHeâe, emeOeeje, Deeveo YejJee)

Purvi (heJee) :- Purvi, Puriya Dhanashri, Paraj (heJee, heejÙee OeveeßJee, hejpe)

Marava (ceejJee**)** :- Marava, Bhatiyar, Bhankhar, Puriya (ceejJee, YeeŠÙeej, YeKeej, heejÙee)

Todi (Iee[e**)**:- Todi, Gurjari Todi, Chaya Todi, Multani (Iee[e, iepeje Iee[e, ÚeÙee Iee[e, ceueIeevee)

Bhairavi (YejJee):- BBhairavi, Malkans, Bhupal, Sindhbhairavi (YejJee, ceeuekeâme, Yeheeue, emeOeYejJee)

Asavari (DeemeeJeje**):-**Asavari, Jainapuri, Gandhari, Devgandhar, Desi, Komal Rishabh asavari (DeemeeJeje, peevehеje, ieeOeeje, oJeieOeej, keâeceue DeemeeJeje, oMee)

Sarang (meejie):- Brindavani Sarang, Megh, Shudhdha Sarang, Madhmad Sarang (eyevõeyevee meejie, celе, MeOo meejie, ceOeceeo meejie,)

Dhanashri (Oeveeßee **)**:- Dhanashri, Bhimpalasi, Dhani, Patdeep, Pradipaki, Hanskinkini (Oeveeßee, Yeeceheueemee, Oeevee, heŠoehe, ØeoehekeâeеnmeekeâekeâCee)

Lalat (ueuele**)** :- Lalat, Basant, Pancham, Prabhat Lalitagauri (ueuele, yemevle, heÛece, ØeYeele, ueeueleeieeje)

Pilu (heeue **)**:- Pilu, Barava, Badhans (heeue, yejJee, ye[nme)

Sorath (mеej"**)** :- Sorath, Des, Tilak Kamod, Jayjayvanti (meej", ome, eleuekeâ keâeceeo, peÙepeÙeJele)

Bibhas (eyeYeeme**)**:- Bibhas, Reva, Jaytashri (eyeYeeme, jJee, peÙeleeßee)

Nat (veš**)** :- Nat, Guod (veš, iee[)

Shri (ßee):- Shrirag, Tirvan, Chaiti, Deepak (ßeejeie, elejJeve, Ûelee, oehekeâ)

Bageshri (yeeießee**)** :- Baghri, Rageshwari, Bahar, Kuoshi Kanada (yeeießee, jeieÕeje, yenej, keâeeMe keâeve[e)

Kedar (keâoej **)**:- Kedar Nat, Bhavani Kedar, Kamod, Jaldhar Kedar (keâoej veš, YeJeevee keâoej, keâeceeo, peueOej keâoej)

Shankara (Mekeâje**)**:- Shankara, Malashri, Bihag, Hansdhvani (Mekeâje, ceeueßee, eyeneie, nmeOJeeve)

kanada (keâeve[e**)** :- Darbari**,** Adana, Sugharai, Shahana, Nayaki, Gunji Kanada, Kanada Malhar, Huseni Kanada, Mudriki, Kausi, Abhogi:-(ojyeejle, De[evee, melejeF, Menevee, veeÙekeâe, iepeekeâeve[e keâeve[eceunej, nmevee keâeve[e, ceeõkeâe, keâemee, DeeYeeiee,)

Malhar (ceunej **)**:- Malhar, Ramdasi malhar, Sur Malhar, Gaudmalhar, Meghmalhar, Natmalhar, Dhundiyamalhar (ceunej, jeceoemeeceunej, mejceunej, iee[ceunej, celeceunej, vešceunej, Ûejpekeâeceunej, Oee[Ùee ceunej)

Hindol (en[eue):-Hindol, Sohani, Bhinnshadja, Shudhdha Sohani (en[eue, meenvee, eYeVe<e[pe, MeOo meenvee)

Bhupali (Yeheeuee **)**:- Bhupali, Deskar, Jayat, Jayat kalyan (Yeheeuee, omekeâej, peÙele, peÙele keâuÙeeCe)

Asa (Deemee**)** :- Asa, Durga, Bhavani (Deemee, oiee, YeJeevee)

Chapter 5
Frequency of swara

Sound is a mechanical wave that is an oscillation of pressure transmitted through solid, liquid, or gas, composed of frequencies within a range of hearing and of a level sufficiently strong to be heard. Also sound is a series of longitudinal and compression waves that move through air.

The characteristics of the wave form are that it has an amplitude, wave length, frequency and velocity. The wave length is a distance between amplitude maximums or the distance between any point on a wave and equivalent point on the next phase. Literally the length of the wave.

The frequency is how often the maximums or crests move past a given time or the number of times the wave length occurs in one second. The faster the sound source vibrates the higher the frequency. Higher frequencies are interpreted as a higher pitch. For example, when you sing in a high pitch voice you are forcing your vocal chord to vibrate quickly.

Pitch represents the perceived fundamental frequency of sound. It is one of the major auditory attributes of musical tones along with duration, loudness, timbre and sound source location. Pitches are compared higher and lower in the sense that allows the construction of melodies. Pitch may be quantified as a frequency in cycle per second (Hertz) Hz.

Audio means of sound or the 'representation of sound', Specifically it refers to the range of frequencies detectable by human ear approx. lowest 20 Hz to max. 20 KHz

Amplitude is the strength or power of a wave signal, the hight of the wave when viewed as a graph. Higher amplitudes are interpreted as a higher volume, hence the name amplifier for device which increases amplitude.

1) The process begins with a sound source, such as human voice, which creats waves of sound (acoustical energy)
2) These waves are detected by transducer (microphone), which converts them to electrical energy.
3) The electrical signal from the microphone is very weak and must be fed to an amplifier before anything serious can be done with it.
4) The loudspeaker converts the electrical signal back in to sound waves which are heard by human ear.

We want to measure the frequency of a swar from recording. We get (pressure x time), or (voltage x time) wave format of the particular swar from computer. To convert this in to (energy x frequency), we took help of Fourior equation. According to This equation any periodic function can be expressed in sine and cosine language means a graph of (pressure x time) can be converted in to (energy x frequency).

To prove that the same swar behaves differently in different ragas or the same swar has different shruties or different frequencies in different ragas, the following experiment was done.

To find the frequencies of...

1) Komal Rishabh :- Todi, Multani, and Marava ragas were selected.
2) Tivra Madhyam :- Todi, Multani, Yaman, marava ragas were selected

3) Komal Gandhar :- Todi, Multani, Darbari Kanada, Shuddha Rishabh Asavari, Bhimpalas, and Bageshri were selected

4) Komal Dhaivat :- Todi, Multani, Asavari, and Darbari Kanada ragas were selected

5) Shuddha Dhaivat :- Marava, Bhup, Hamir, and Yaman ragas were selected

6) Komal Nishad :- Asavari, Bhimpalas, Bageshri, and Darbari Kanada were selected.

The aroh and avaroh of selected ragas were recorded in madhya saptak of Black 2 scale, in human voice. The man who sung the same is a well known singer of Hindustani classical music.

He was asked to hold 5 to 10 seconds on the swar whose frequency was to be found out. From the recording of his singing (pressure x time) graphs were obtained. This was then converted in to (frequency x energy) with the help of Fourier equation. In these graphs along with the basic or fundamental frequency, other harmonics were also obtained. The selection of a frequency was done from the harmonics of madhya saptak. These frequencies when compared with the frequency table prepared by Dr Oak, were found very near to frequency given in the table.

Raga Multani :-

In this raga rishabh, gandhar and dhaivat are komal, madhyam is tivra, and all other swaras are shuddha.

Jati :- odav sampurna

Vadi :- pancham Savadi :- shadja

Time :- 3pm to 6pm

Deejen :- eve mee ce ie ce- he eve mee

DeJejen :- mee eve Oe ce he ce-ie ce- ie j mee

This rag is of todi anga and all swaras are like todi.

Komal gandhar always takes the anch of tivra madhyam.

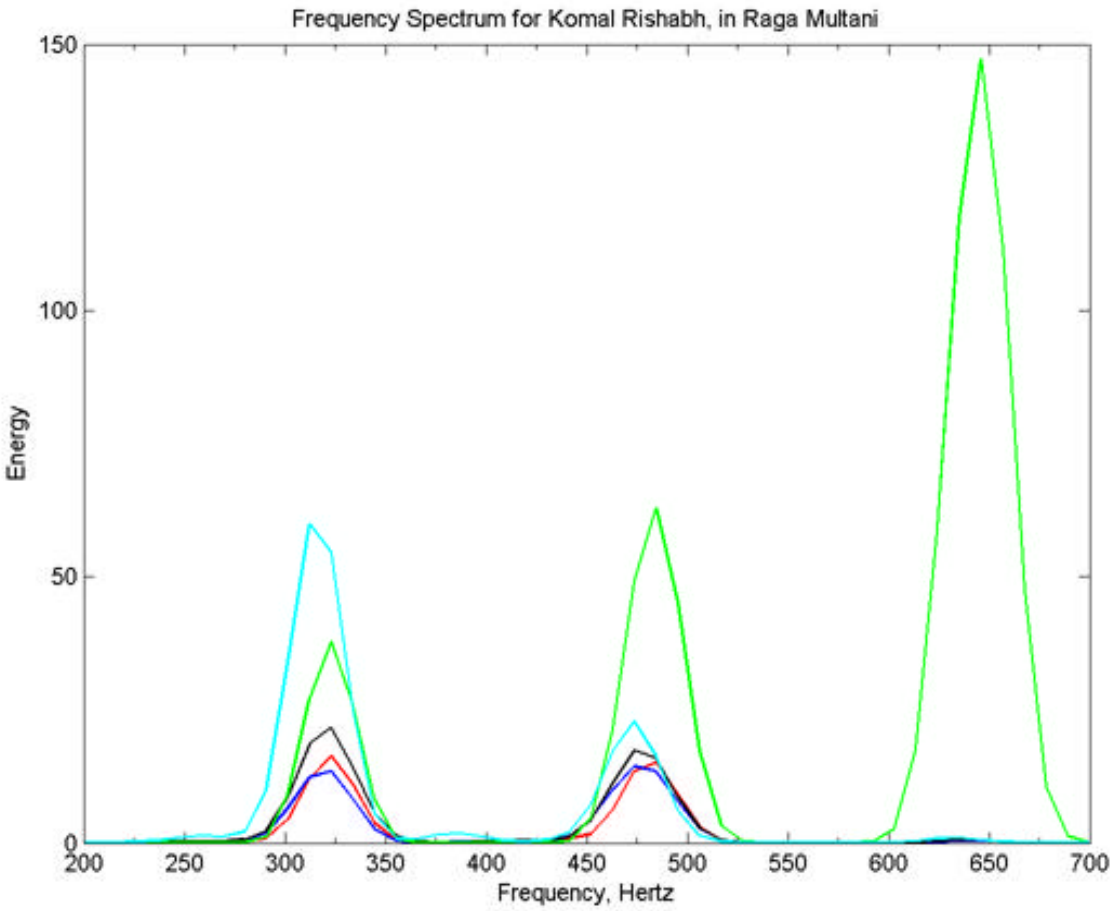
Nyas is on pancham

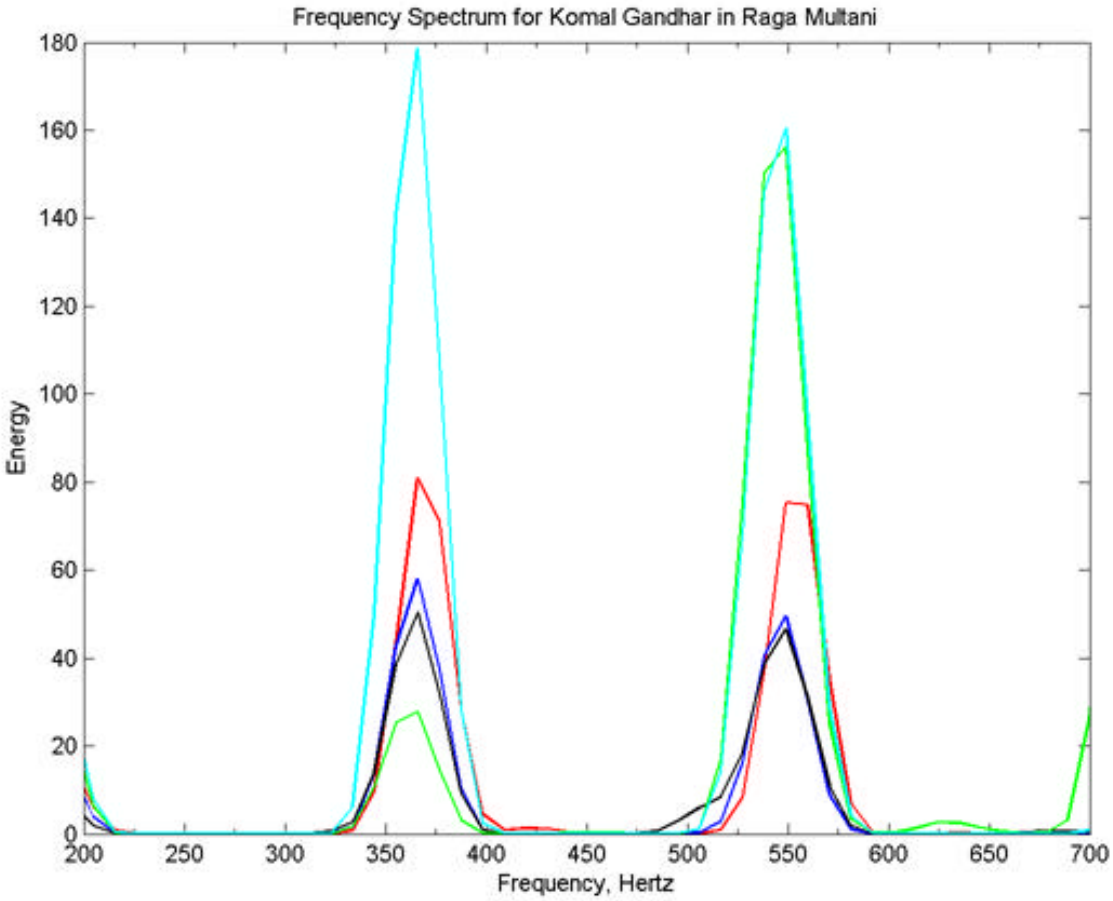
Expected rasa from this raga are 'karun' and 'shrungar'

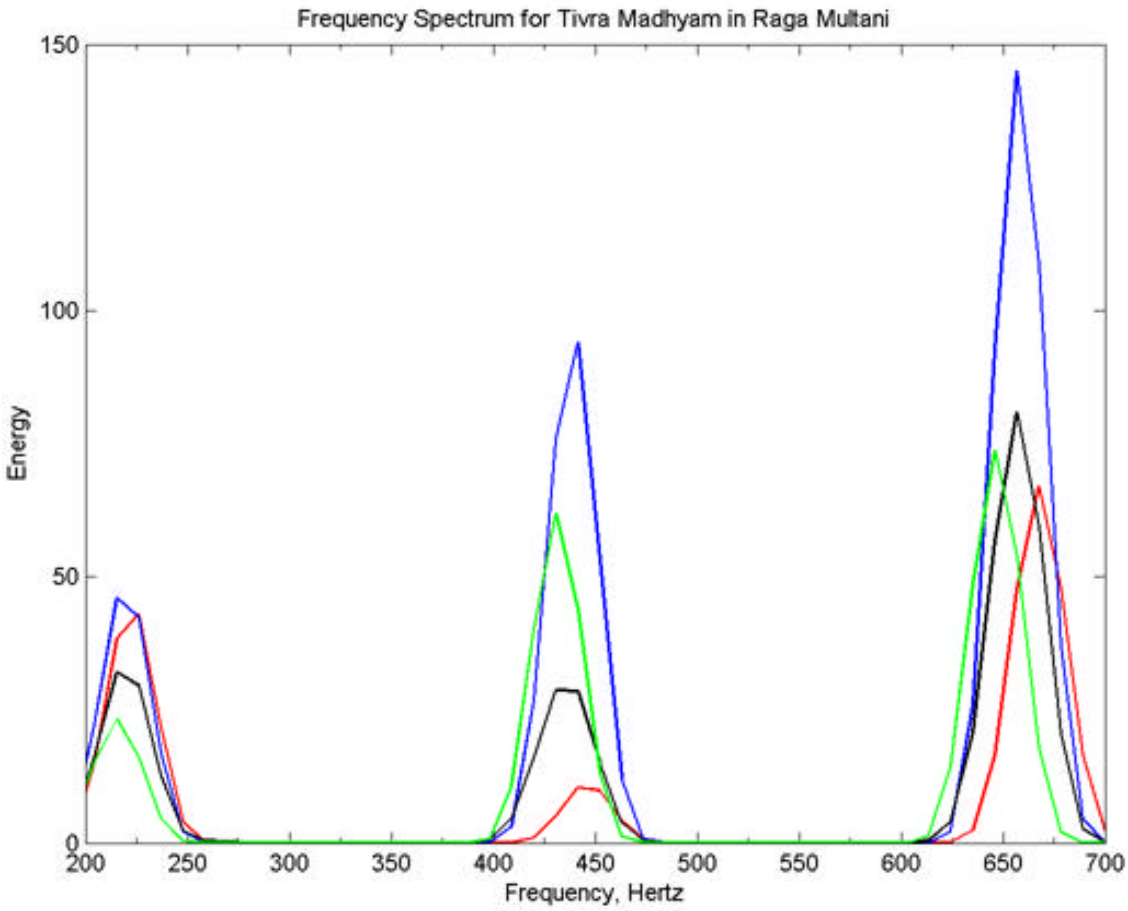
Komalrishabh comes only in avaroh and it comes after komal gandhar , that is why it goes near to shadja.

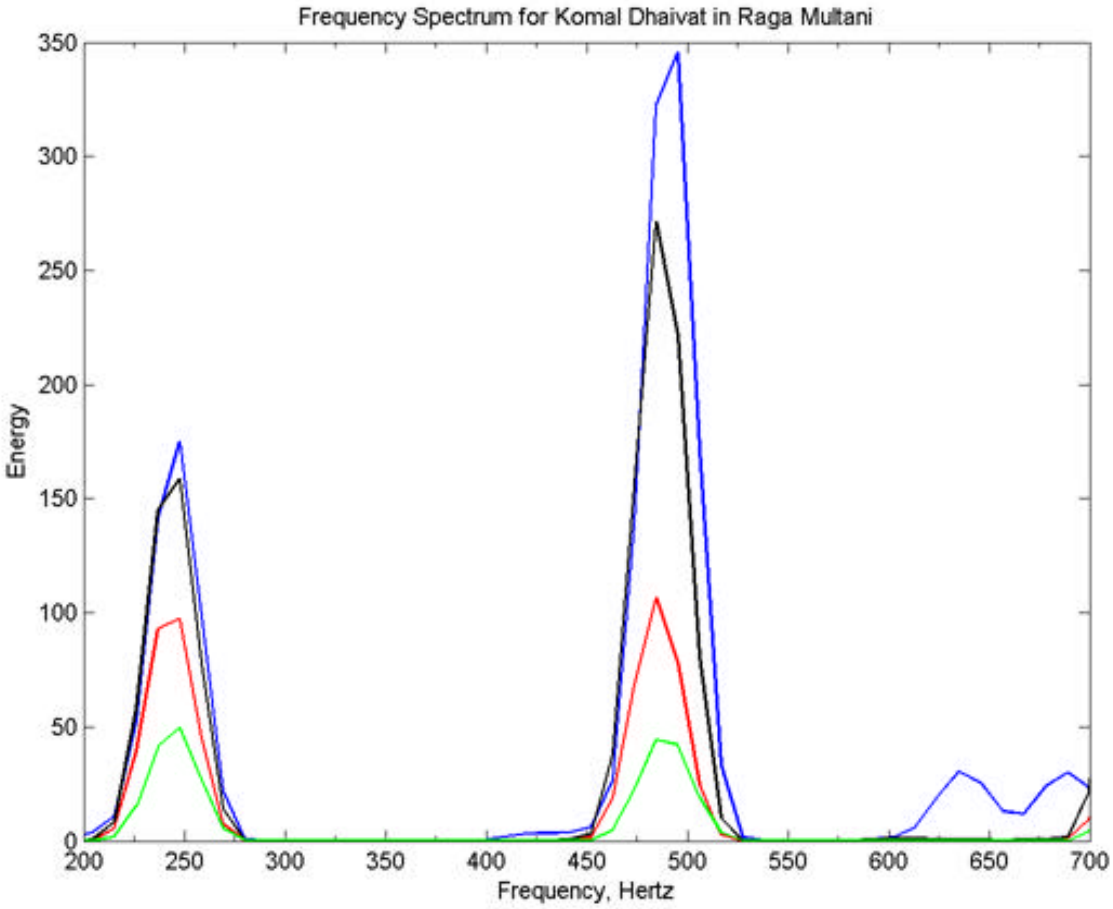
Frequency obtained on computer:-

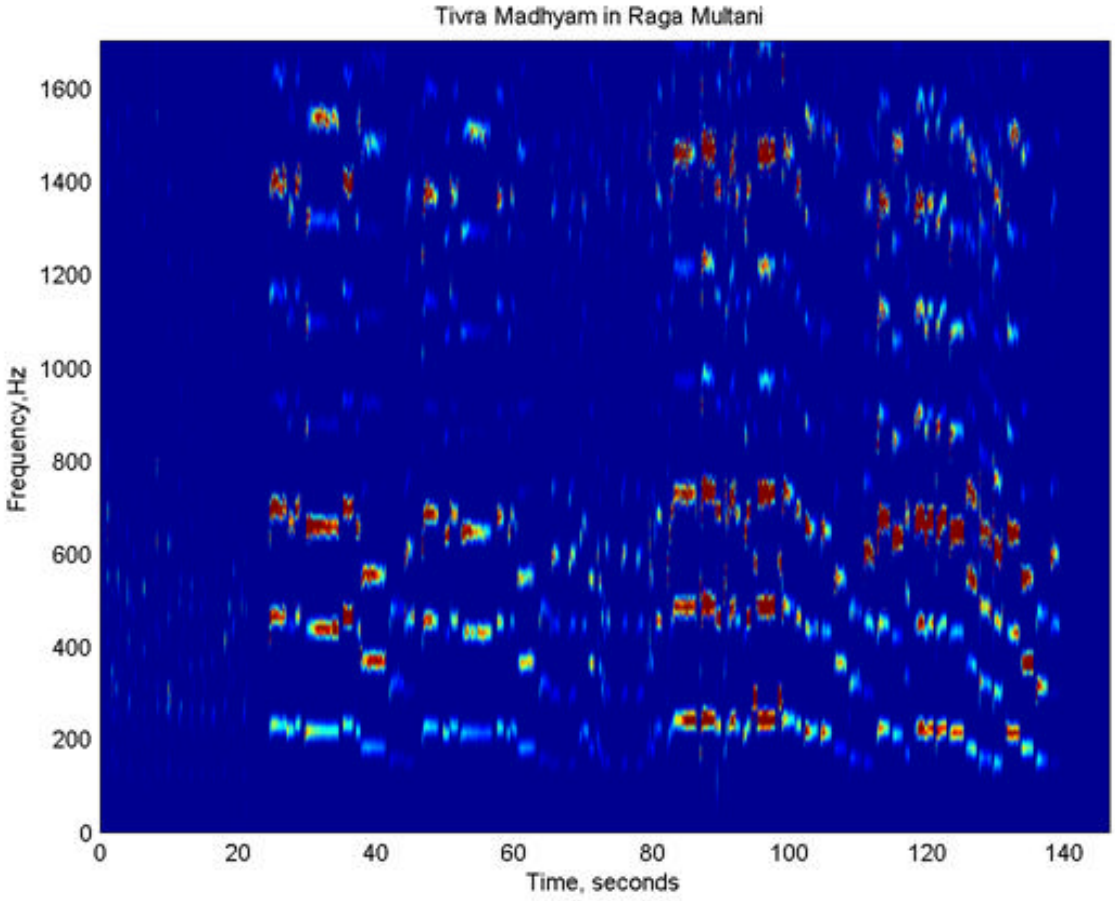
komal rishabh	312 -323	Dr Oak' table 327
komal gandhar	366	368
tivra madhyam	430 – 441	420 – 437
komal dhaivat	484 – 495	497


Frequency Spectrum for Komal Rishabh, in Raga Multani
150
100
50
0
Energy
200
250
300
350
400
450
500
550
600
650
700
Frequency, Hertz


Frequency Spectrum for Komal Gandhar in Raga Multani
Energy
Frequency, Hertz
0
20
40
60
80
100
120
140
160
180
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Tivra Madhyam in Raga Multani
Energy
Frequency, Hertz
150
100
50
0
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Dhaivat in Raga Multani
Energy
Frequency, Hertz
0
50
100
150
200
250
300
350
200
250
300
350
400
450
500
550
600
650
700


Tivra Madhyam in Raga Multani
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
Time, seconds

Raga Todi:-

In this raga rishabh, gandhar, dhaivat are komal, madhyam tivra, and all other swaras are shuddha. Pancham is dropped in aroh

Jati :- shadav sampurna

Vadi :- komal dhaivat Sanvadi :- komal Gandhar

Time :- 8am to 11am

Deejen :- mee j ie ce- Oe eve mee
DeJejen:- mee eve Oe he ce- Oe ce- ie j mee

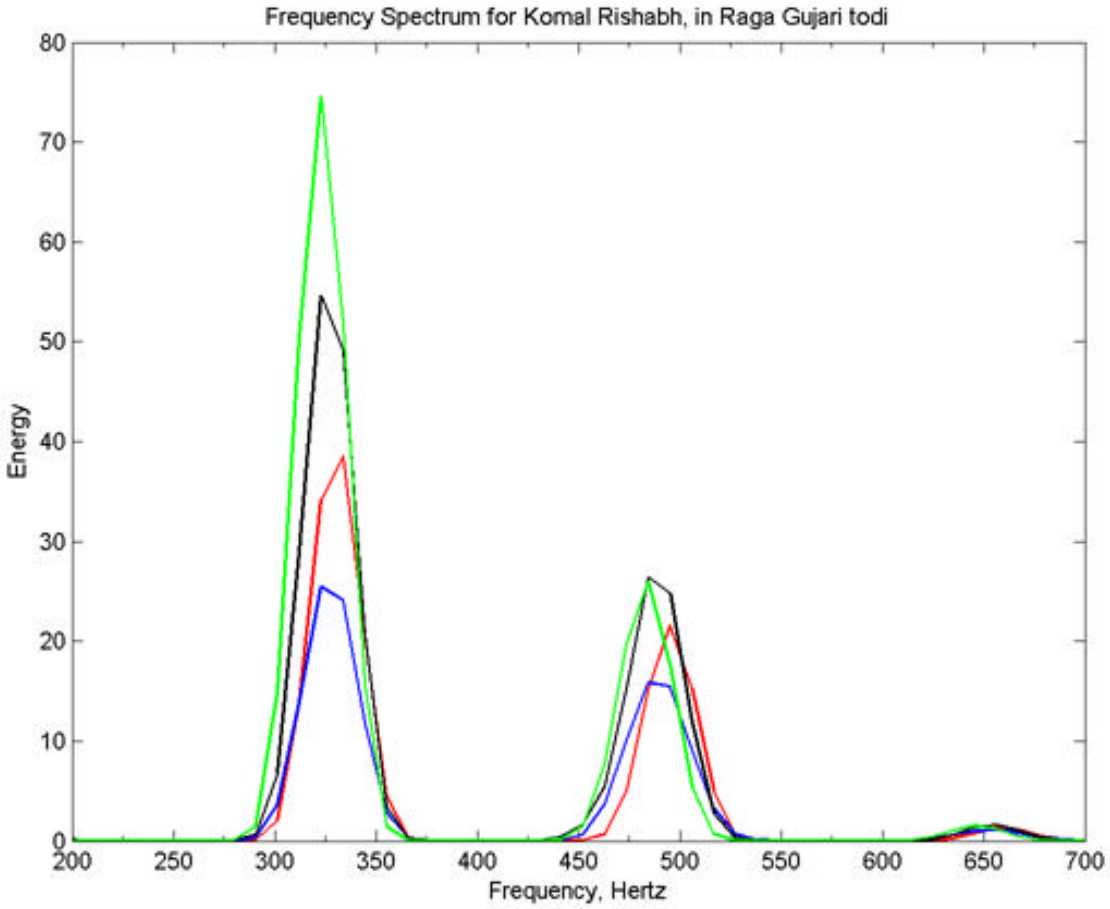
Todi is a janak raga . In this raga gandhar is atikomal and it comes independently. Pancham is used in less praportion and

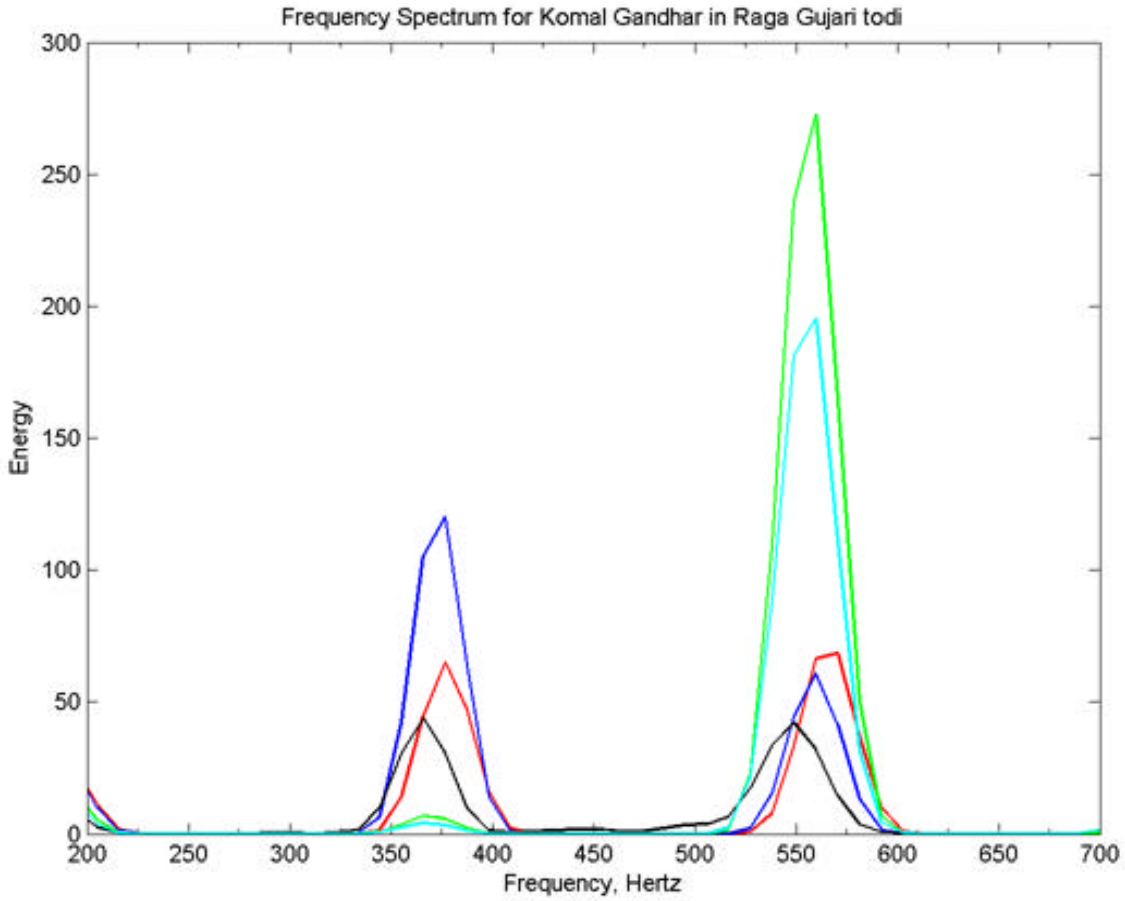
nyas is on komal rishabh.

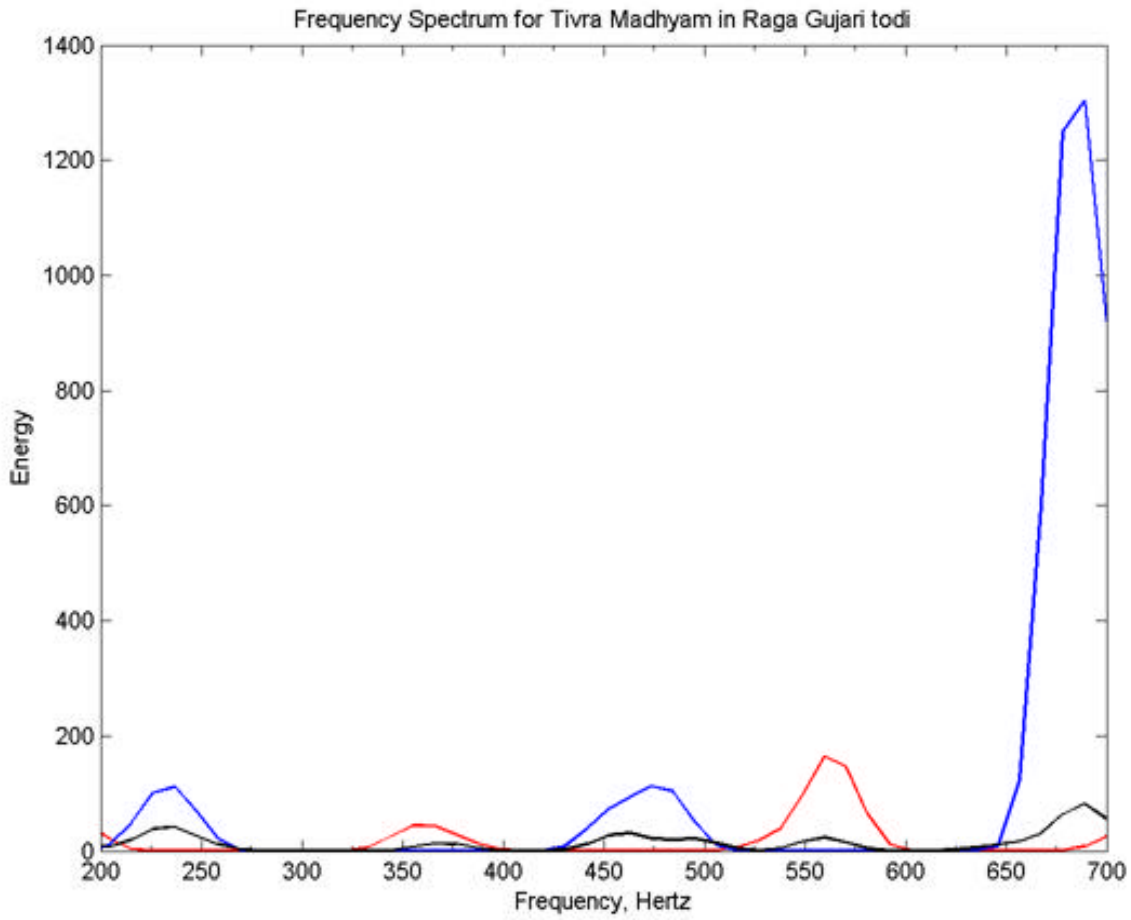
From this raga 'karun and 'bhakti' rasa are expected

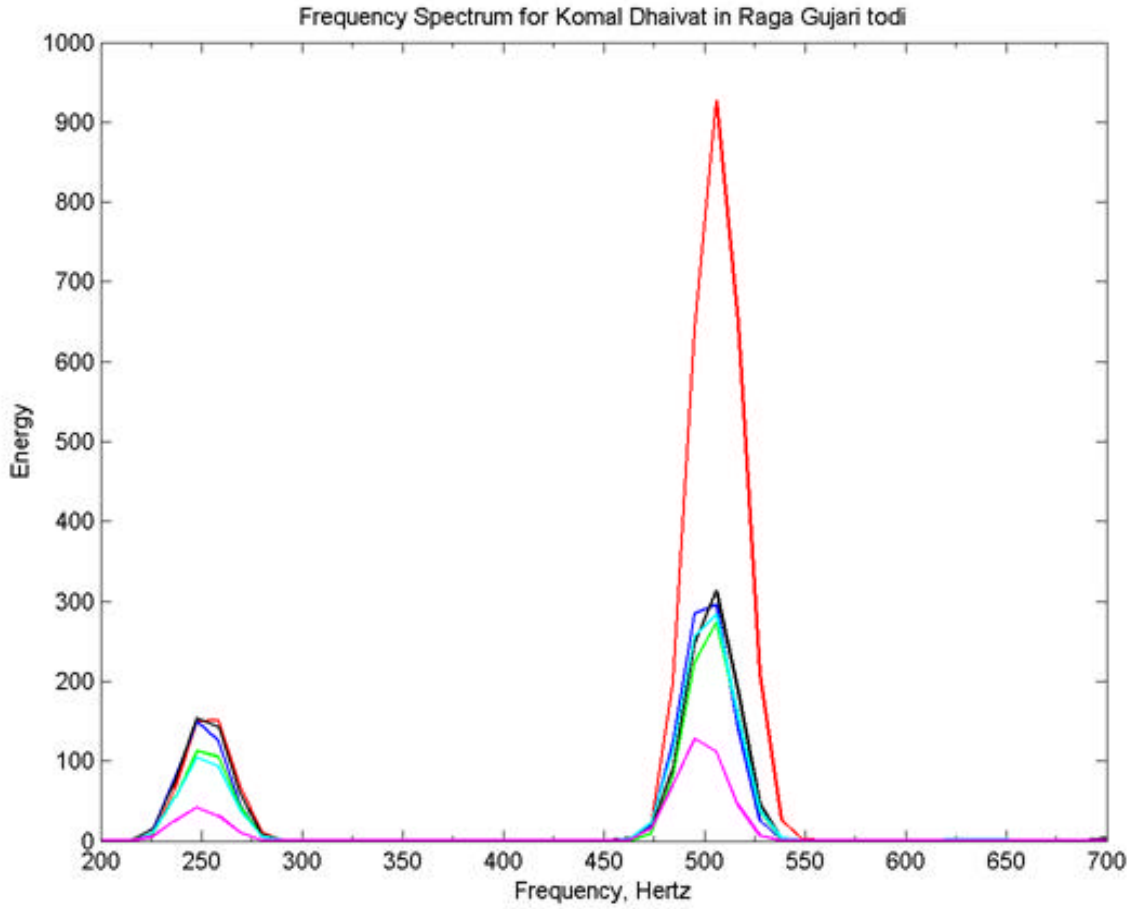
Frequency obtained from computer:-

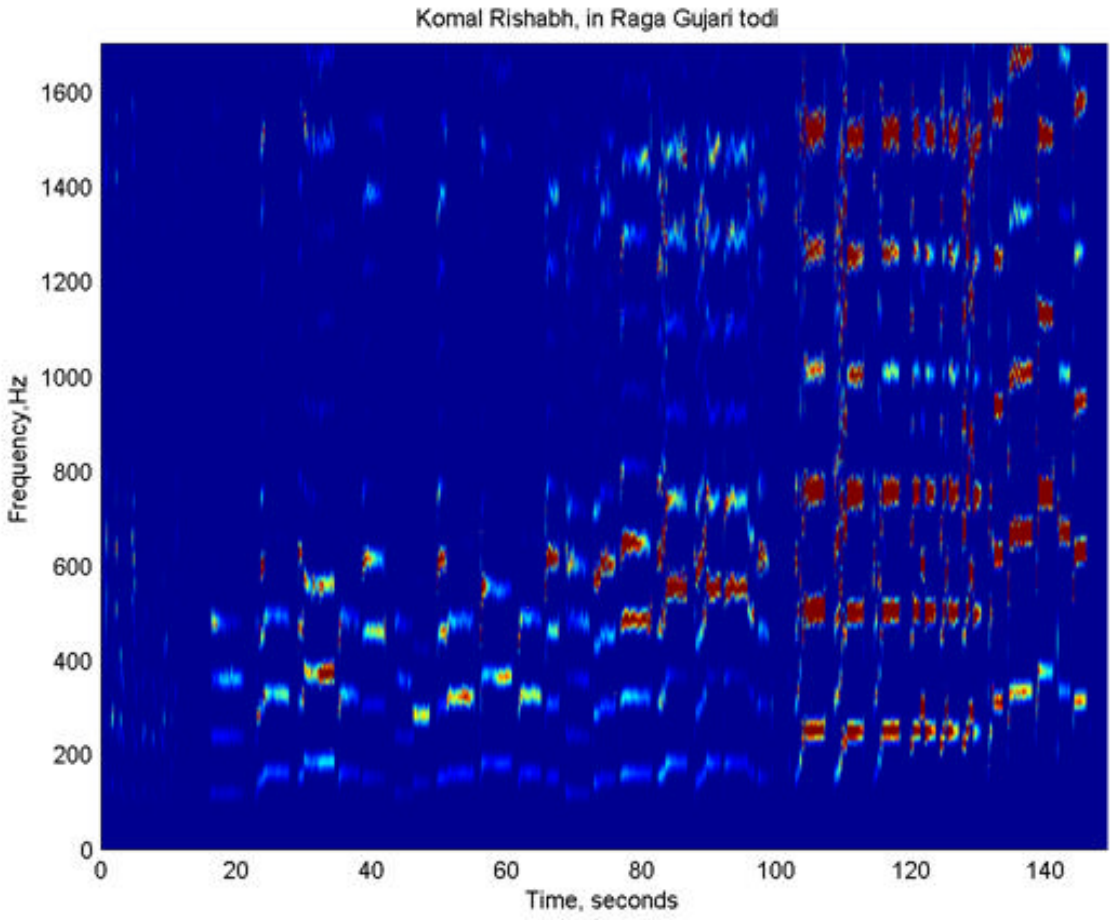
komal rishabh	323 – 330	Dr Oak's table	331
komal gandhar	366- 376		368
tivra madhyam	450 – 453		442
komal dhaivat	500		497


Frequency Spectrum for Komal Rishabh, in Raga Gujari todi
Energy
Frequency, Hertz
0
10
20
30
40
50
60
70
80
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Gandhar in Raga Gujari todi
Energy
Frequency, Hertz
300
250
200
150
100
50
0
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Tivra Madhyam in Raga Gujari todi
Energy
Frequency, Hertz
0
200
400
600
800
1000
1200
1400
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Dhaivat in Raga Gujari todi
Energy
Frequency, Hertz
0
100
200
300
400
500
600
700
800
900
1000
200
250
300
350
400
450
500
550
600
650
700


Komal Rishabh, in Raga Gujari todi
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
Time, seconds

raga Yaman

In this raga madhyam is tivra and all other swaras are shuddha.

Jati :- sampurna

Time :- 6pm to 9pm

Deejen:- eve j ie ce- Oe eve mee
DeJejen:- mee eve Oe he ce- ie j mee

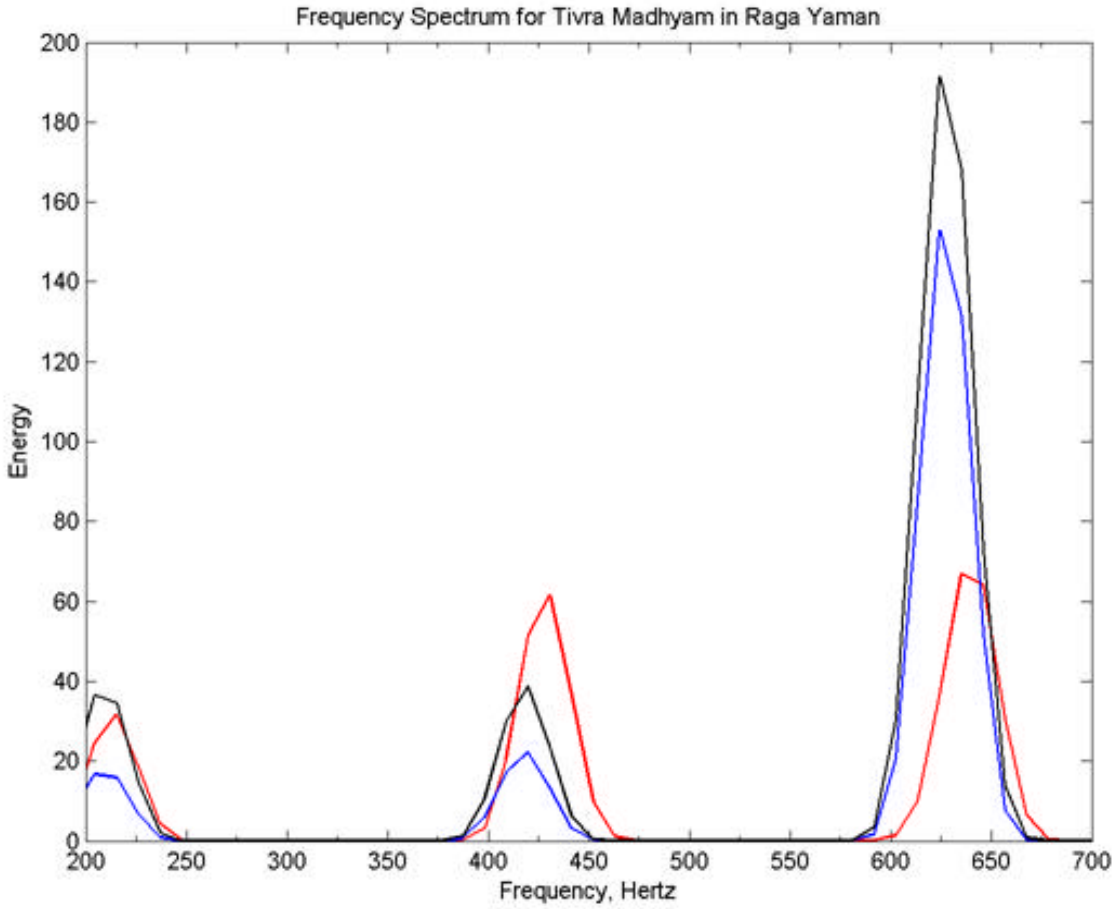
This is janak raga .

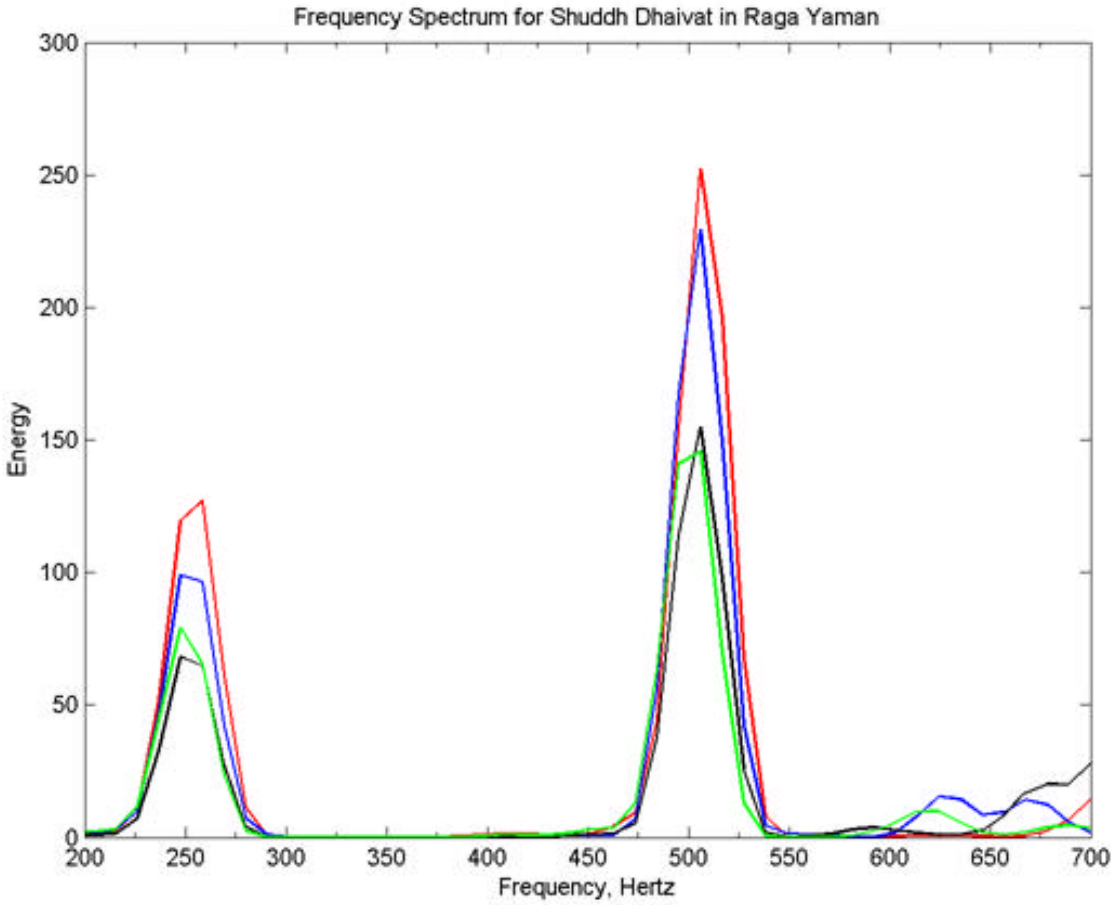
In Aroh ,pancham is either dropped or used in less proportion . Normally alap is started from nishad, in tan shadja and pancham are used in less proportion

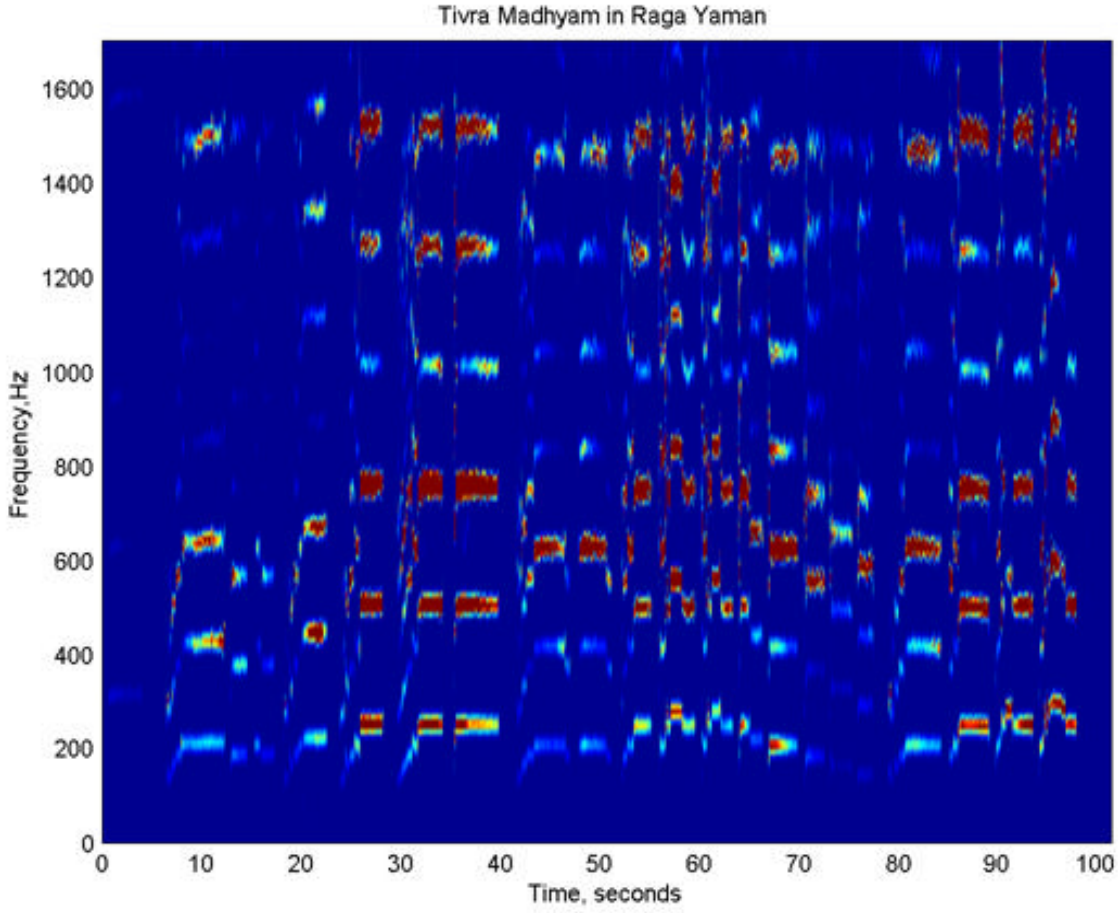
In this raga shuddha dhaivat comes after tivra madhyam

Freqency obtained on computer:-

tivra madhyam	430	Dr Oak' table	420 – 437
shuddha dhaivat	506 – 516		518


Frequency Spectrum for Tivra Madhyam in Raga Yaman
Energy
Frequency, Hertz
0
20
40
60
80
100
120
140
160
180
200
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Shuddh Dhaivat in Raga Yaman
Energy
Frequency, Hertz
300
250
200
150
100
50
0
200
250
300
350
400
450
500
550
600
650
700


Tivra Madhyam in Raga Yaman
Frequency,Hz
0
200
400
600
800
1000
1200
1400
1600
0
10
20
30
40
50
60
70
80
90
100
Time, seconds

Raga Bageshri :-

In this raga gandhar and nishad are komal, all other swaras are shuddha. In Aroh rishabh and pancham are dropped.

Jati :- Odav sampurna

vadi :- madhyam Savadi :- shadja

Time :- 10 pm to 12 pm

Deejen :- mee ^ie ce Oe eve mee

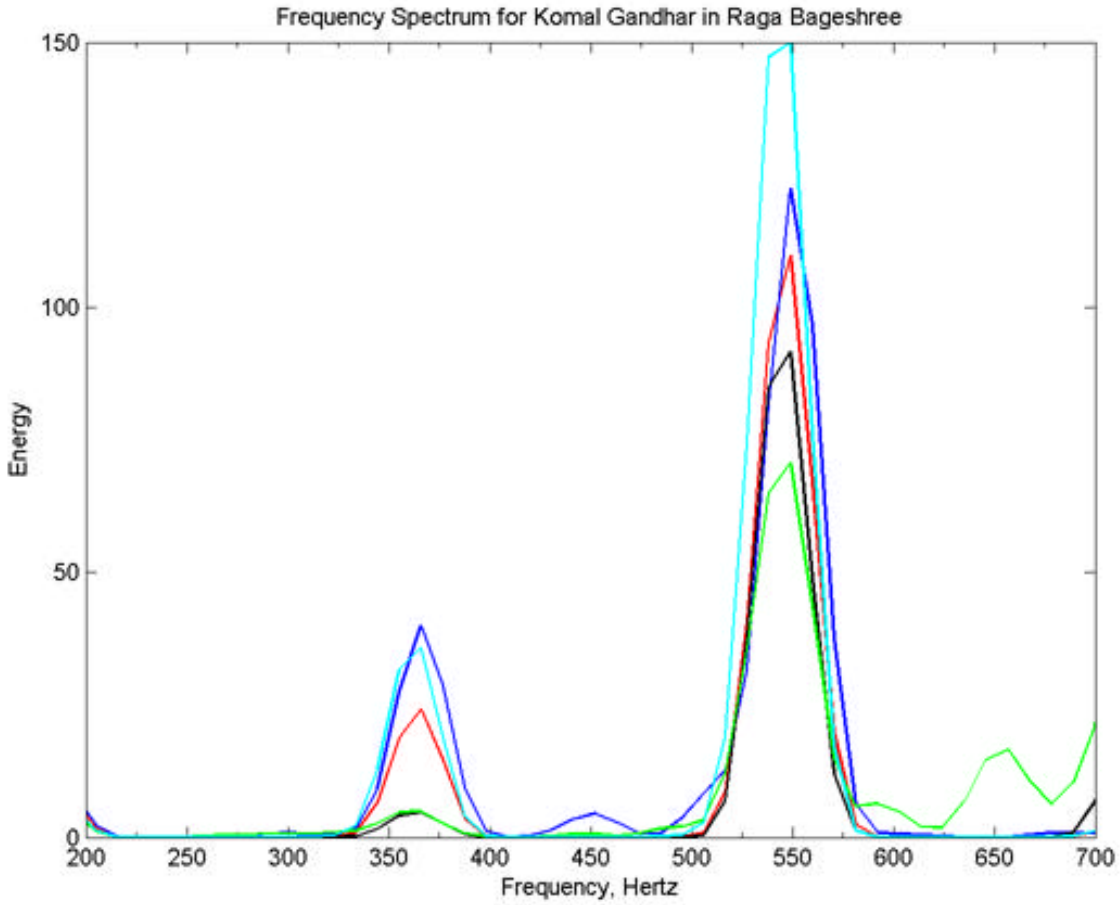
DeJejen :- mee eve Oe ce he Oe ce ^ie j mee

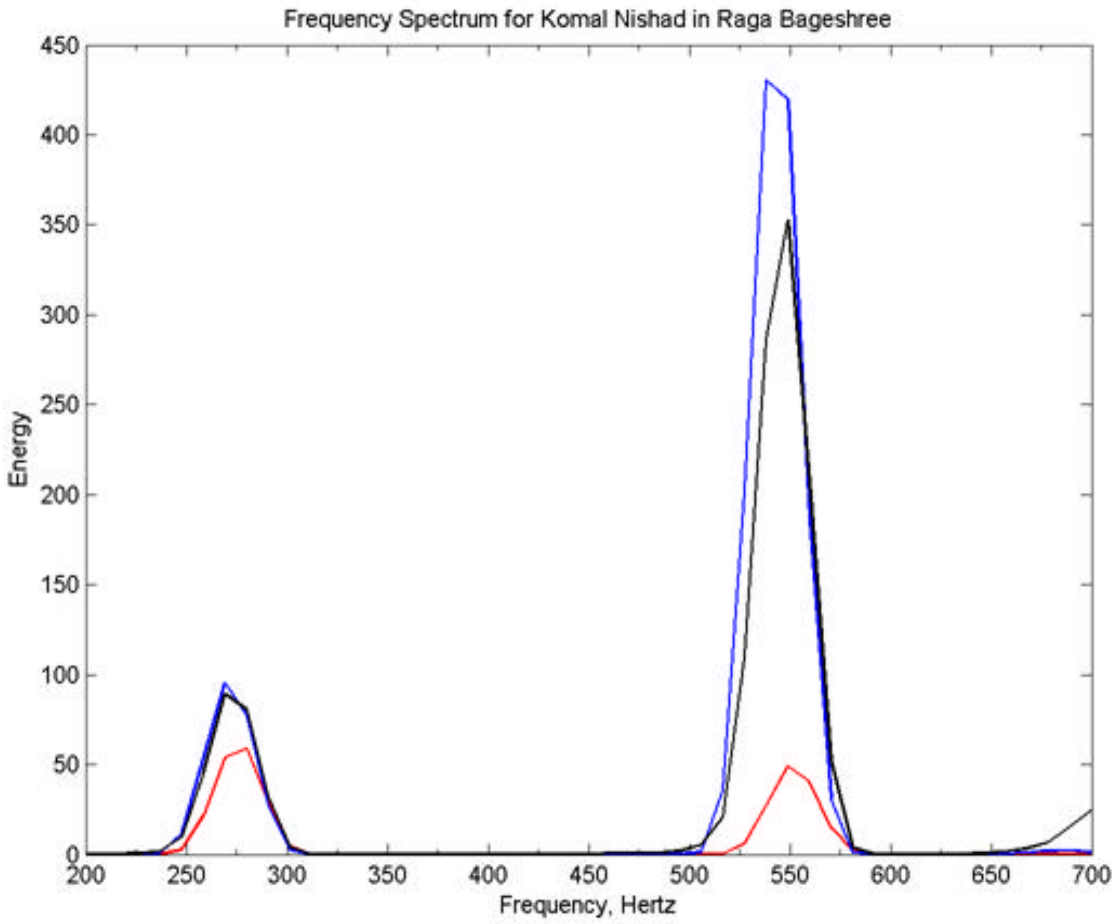
This raga is of kafi ang . In this raga gandhar takes the aas of madhyam and nishad takes the aas of shadja.

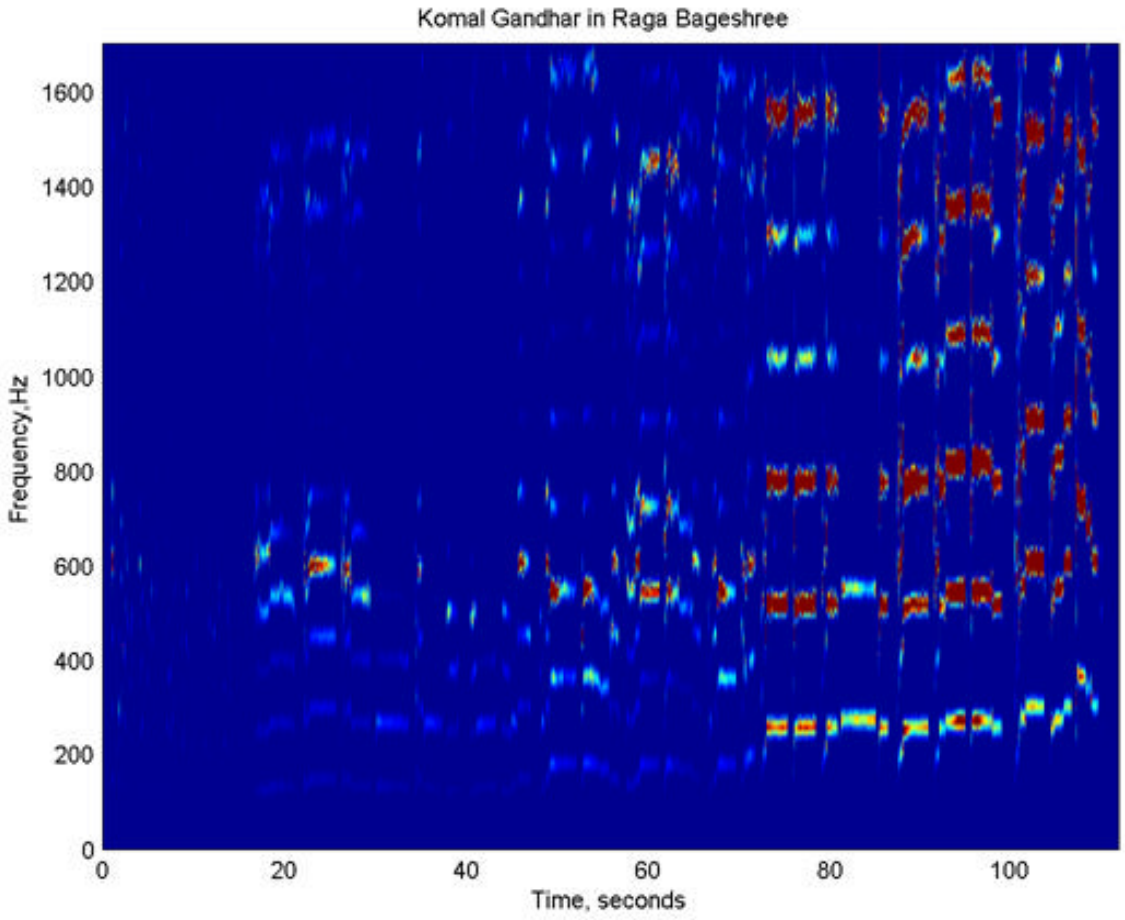
Normally alap end s on komal gandhar or dhaivat

Frequency

komal gandhr	365 – 360	Dr Oak	368
komal nishad	540 – 565		563 – 560


Frequency Spectrum for Komal Gandhar in Raga Bageshree
150
100
50
0
Energy
200
250
300
350
400
450
500
550
600
650
700
Frequency, Hertz


Frequency Spectrum for Komal Nishad in Raga Bageshree
Energy
Frequency, Hertz
0
50
100
150
200
250
300
350
400
450
200
250
300
350
400
450
500
550
600
650
700


Komal Gandhar in Raga Bageshree
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
Time, seconds

Raga Marava :-

In this raga rishabh is komal, madhyam is tivra, pancham is dropped

Jati :- shadav

vadi :- dhaivat Sanvadi :- komal rishabh

Time :- 5pm to 7 pm

Deejen :- eve j ie ce- Oe eve j
DeJejen :- j eve Oe ce- ie j mee
Marava is a janak raga

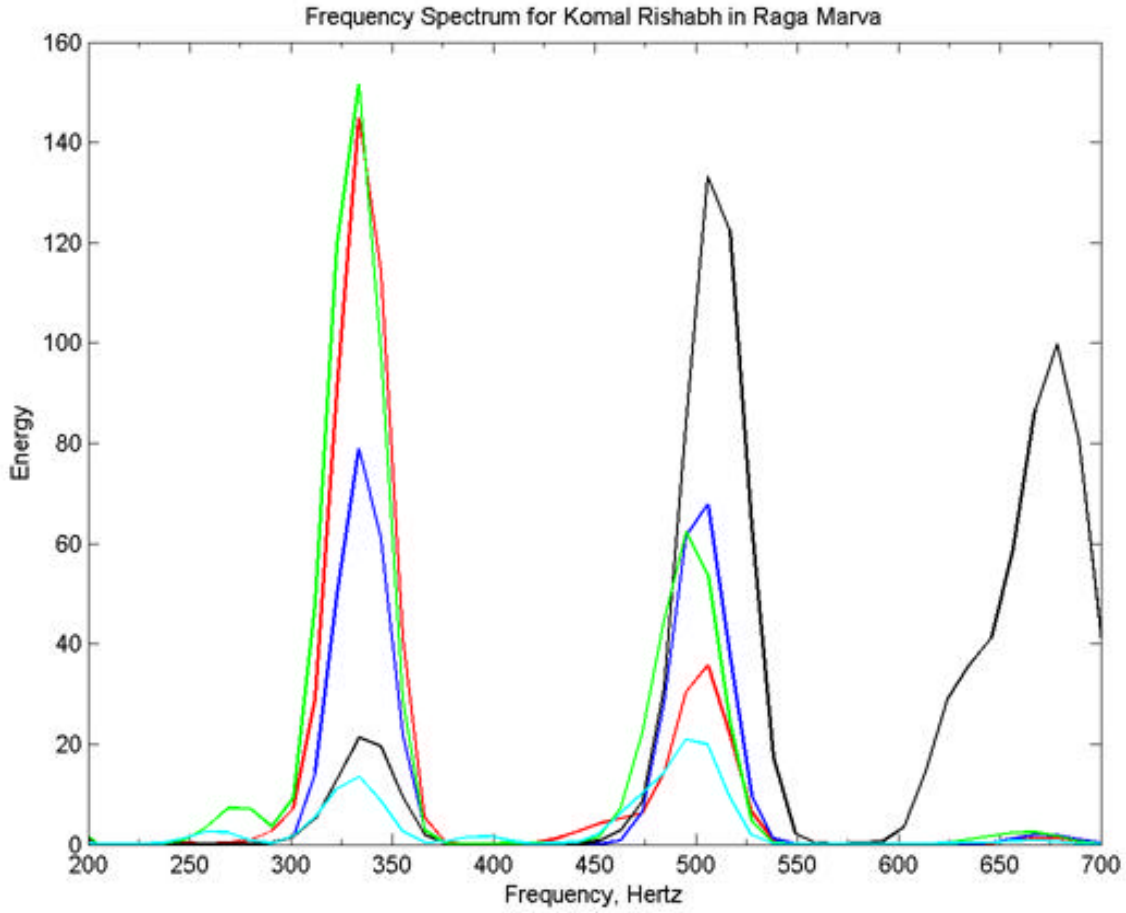
In puvanga komal rishabh is prominant and in uttarang dhaivat is prominant

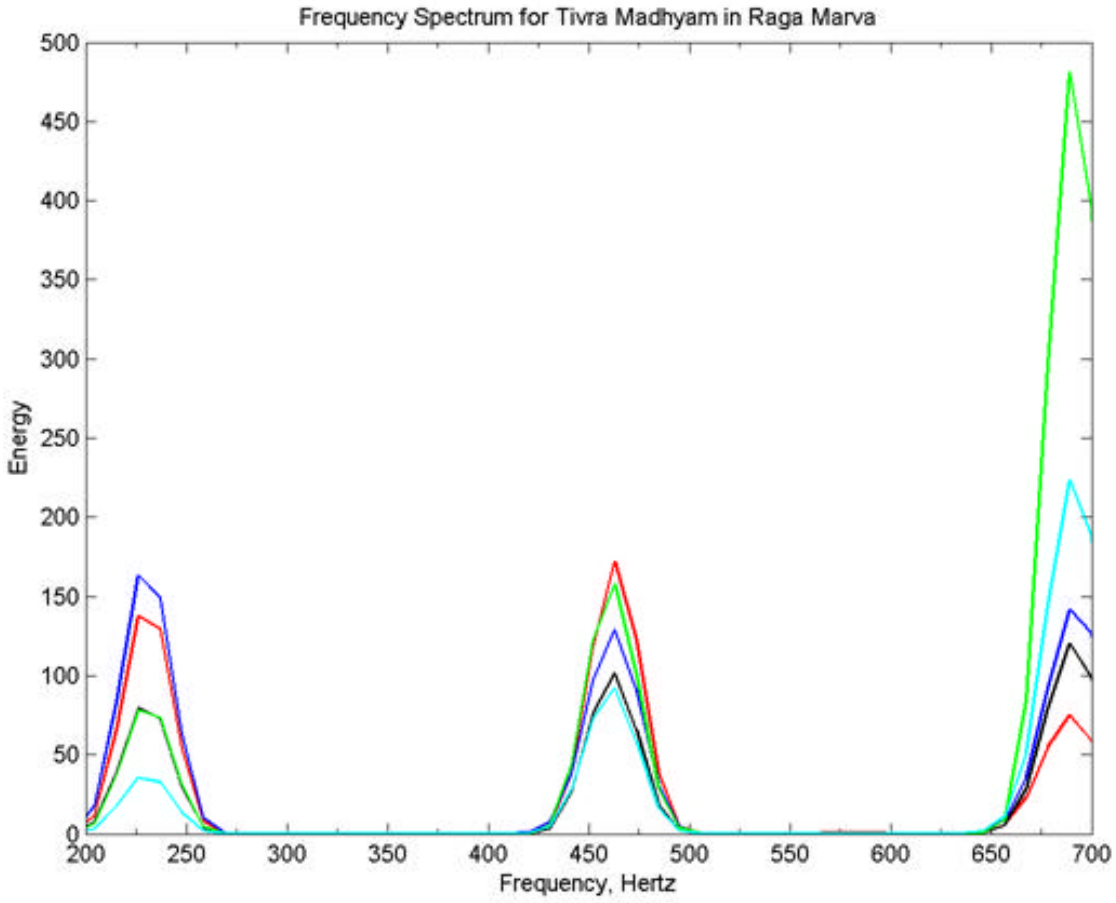
Nyas is on komal rishabh and shuddha dhaivat

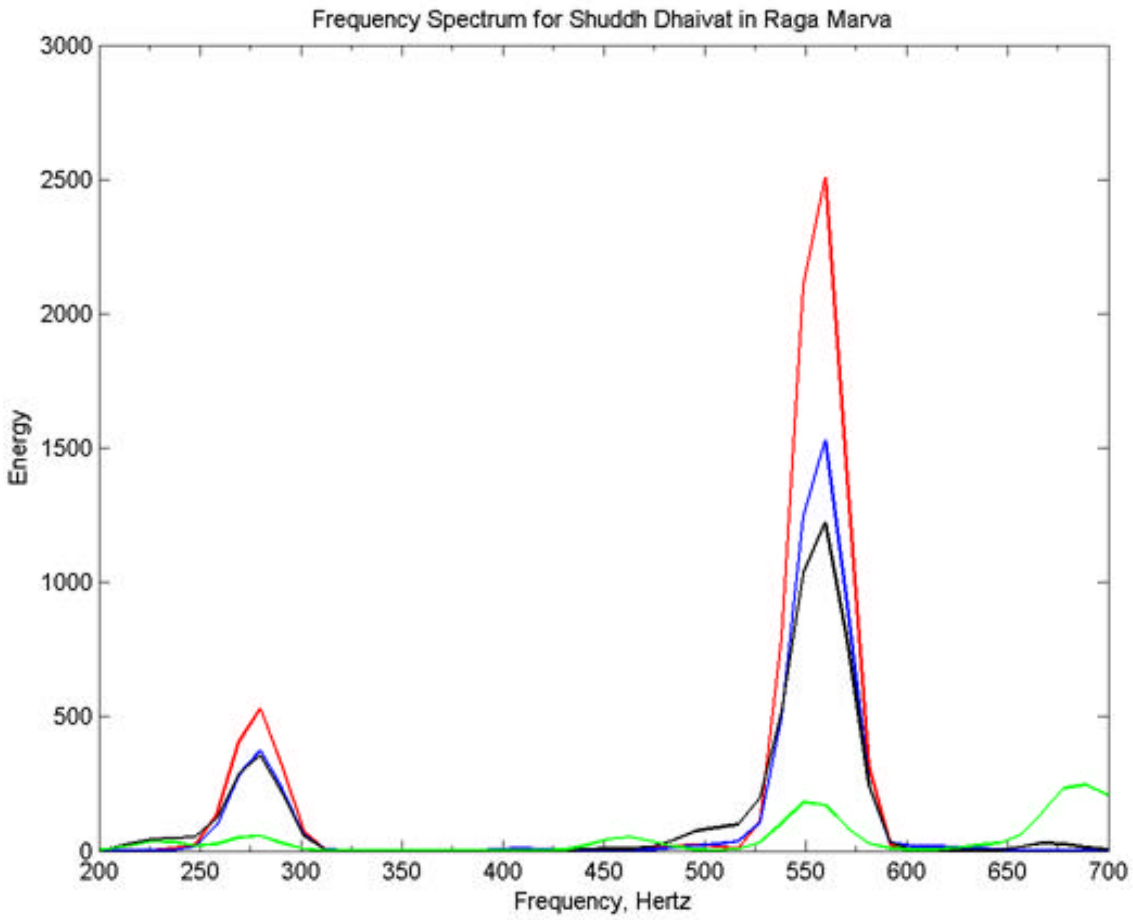
In this raga shuddha dhaivat goes near to shuddha nishad

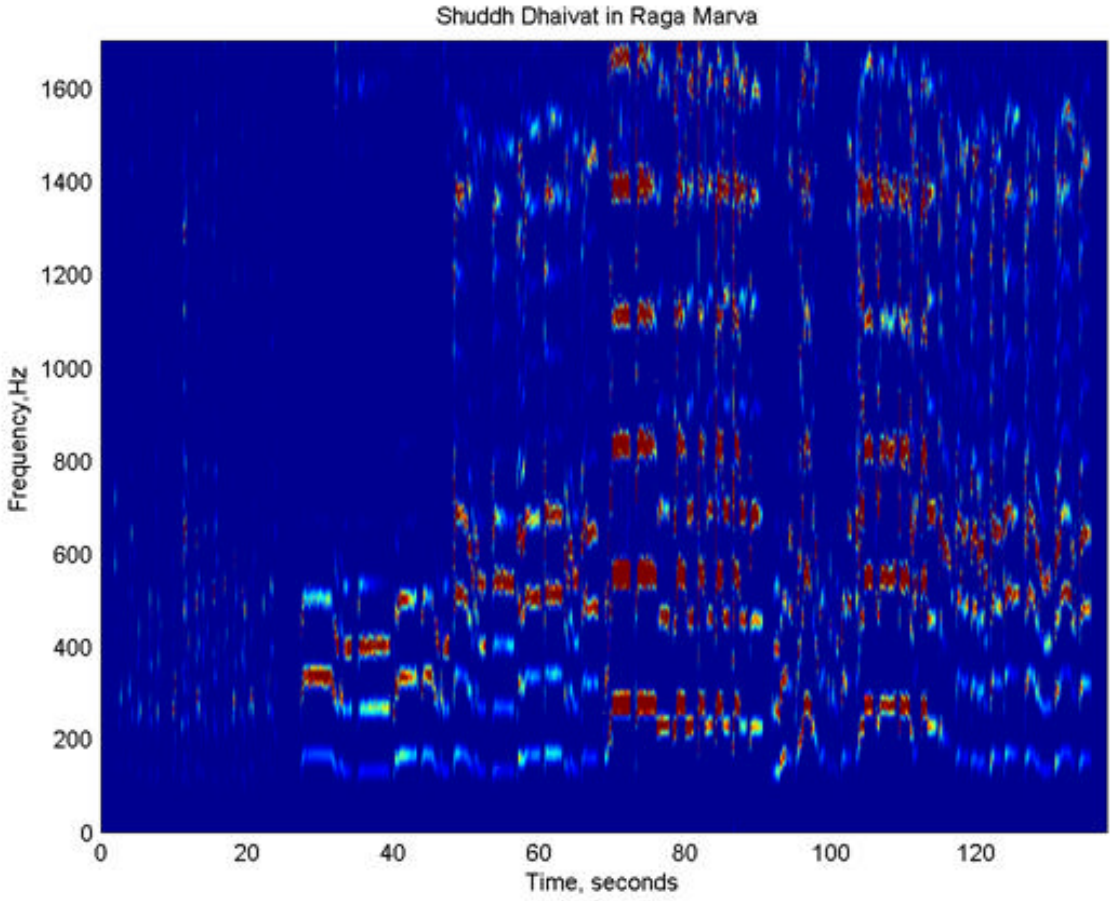
Frequency obaited from computer:-

komal rishabh	332	Dr Oak' table	331
tivra madhyam	450 – 460		442
shuddha dhaivat	560		575


Frequency Spectrum for Komal Rishabh in Raga Marva
Energy
Frequency, Hertz
0
20
40
60
80
100
120
140
160
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Tivra Madhyam in Raga Marva
Energy
Frequency, Hertz
0
50
100
150
200
250
300
350
400
450
500
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Shuddh Dhaivat in Raga Marva
Energy
Frequency, Hertz
3000
2500
2000
1500
1000
500
0
200
250
300
350
400
450
500
550
600
650
700


Shuddh Dhaivat in Raga Marva
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
Time, seconds

Raga Asavari :-

In this raga gandhar, dhaivat and nishad are komal and all other swaras are shuddha. In aroh gandhar and nishad are dropped.

Jati :- odav sampurna

vadi :- komal dhaivat sanvadi :- komal gandhar

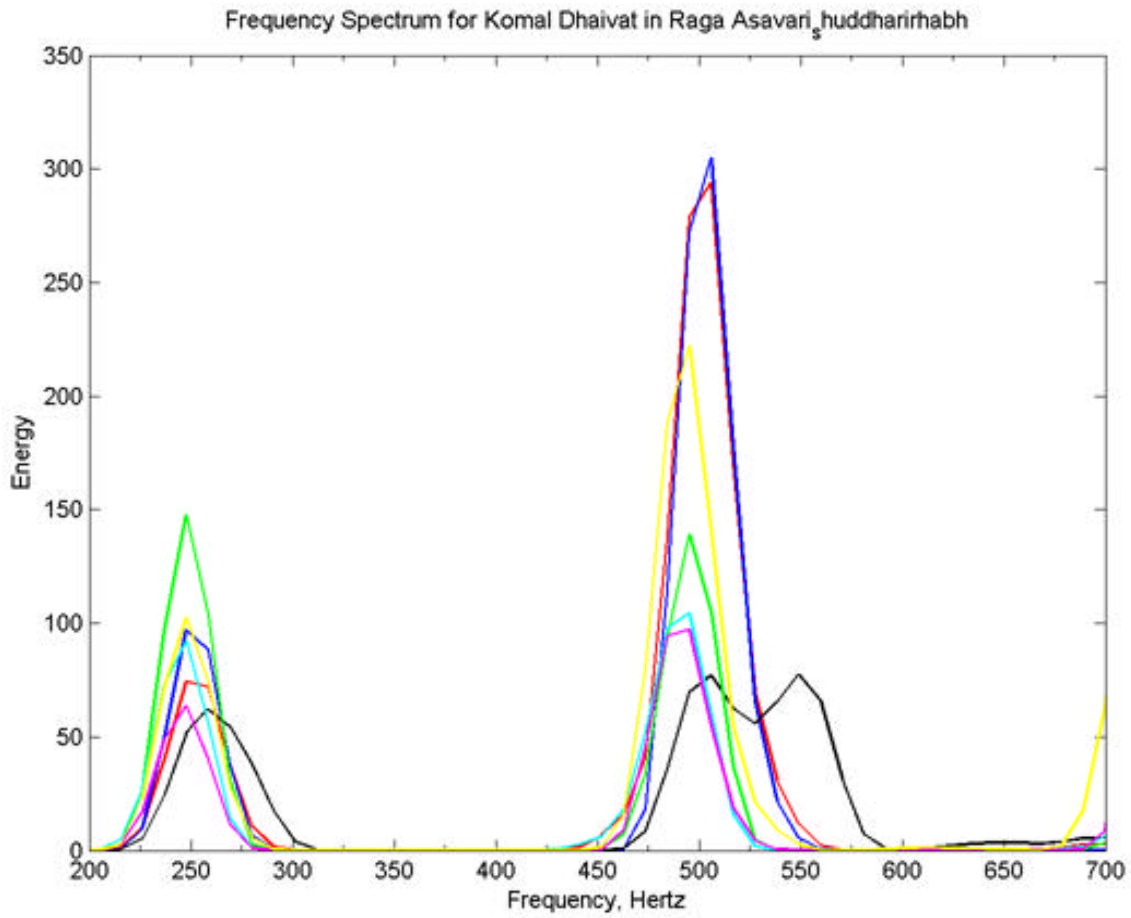
Time :- 9am to 11am

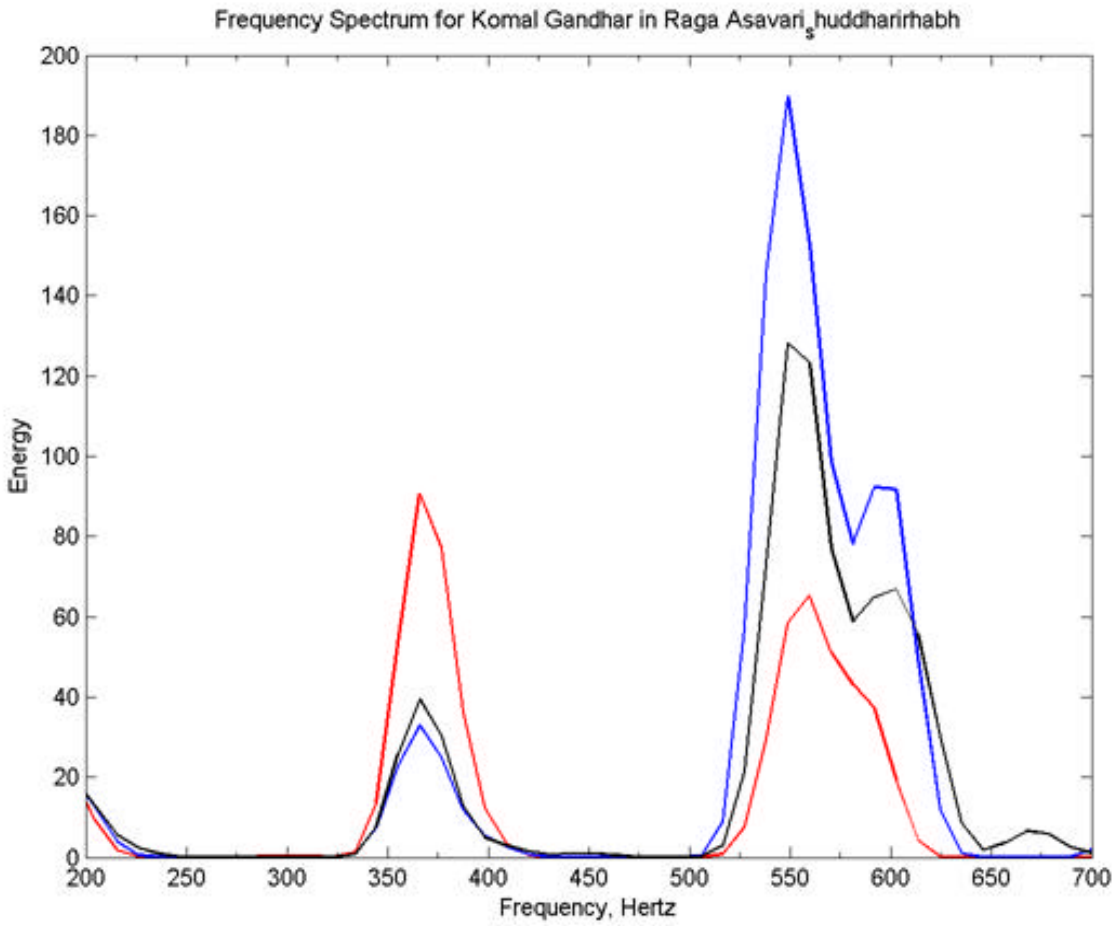
Deejen :- mee, j, ce, he, eveOe, eveOe mee
DeJejen :- mee, eve, Oe, he, ceheOecehe ceie ceie j mee

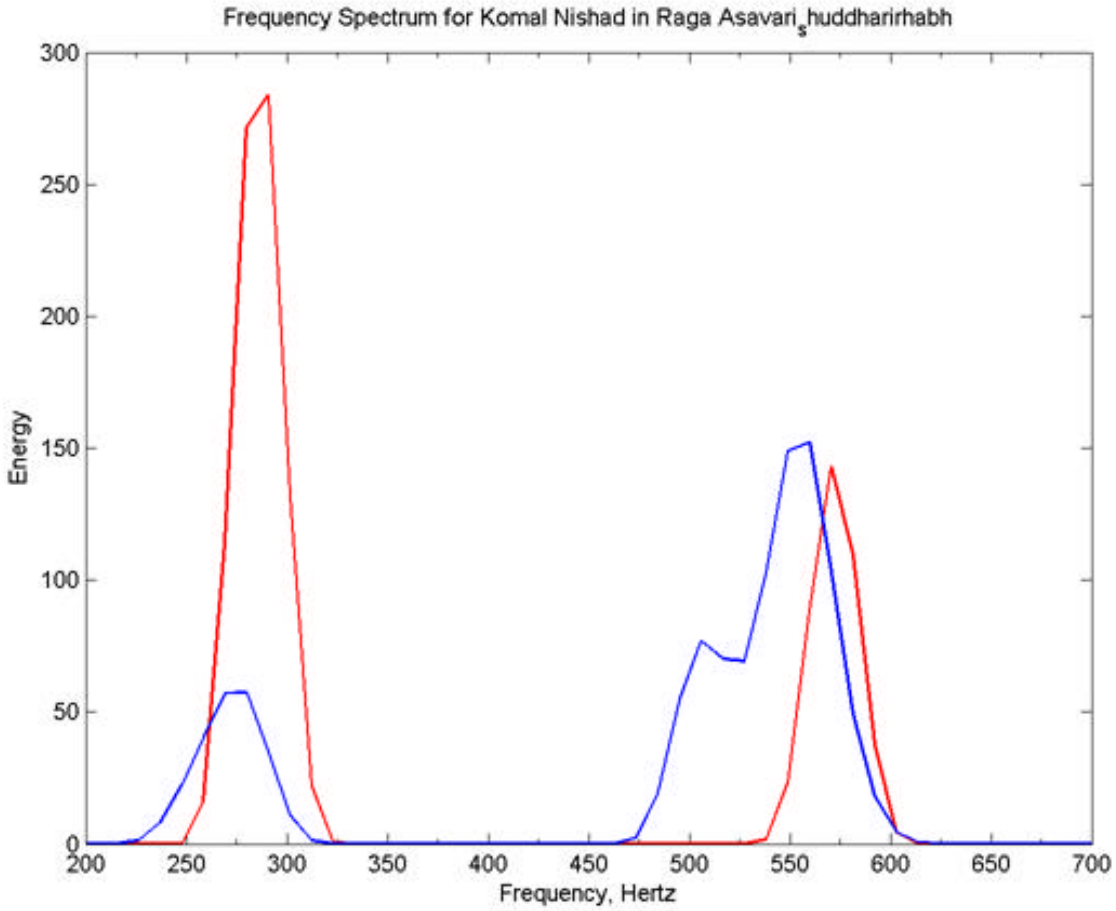
In this raga komal dhaivat takes aas of komal nishad

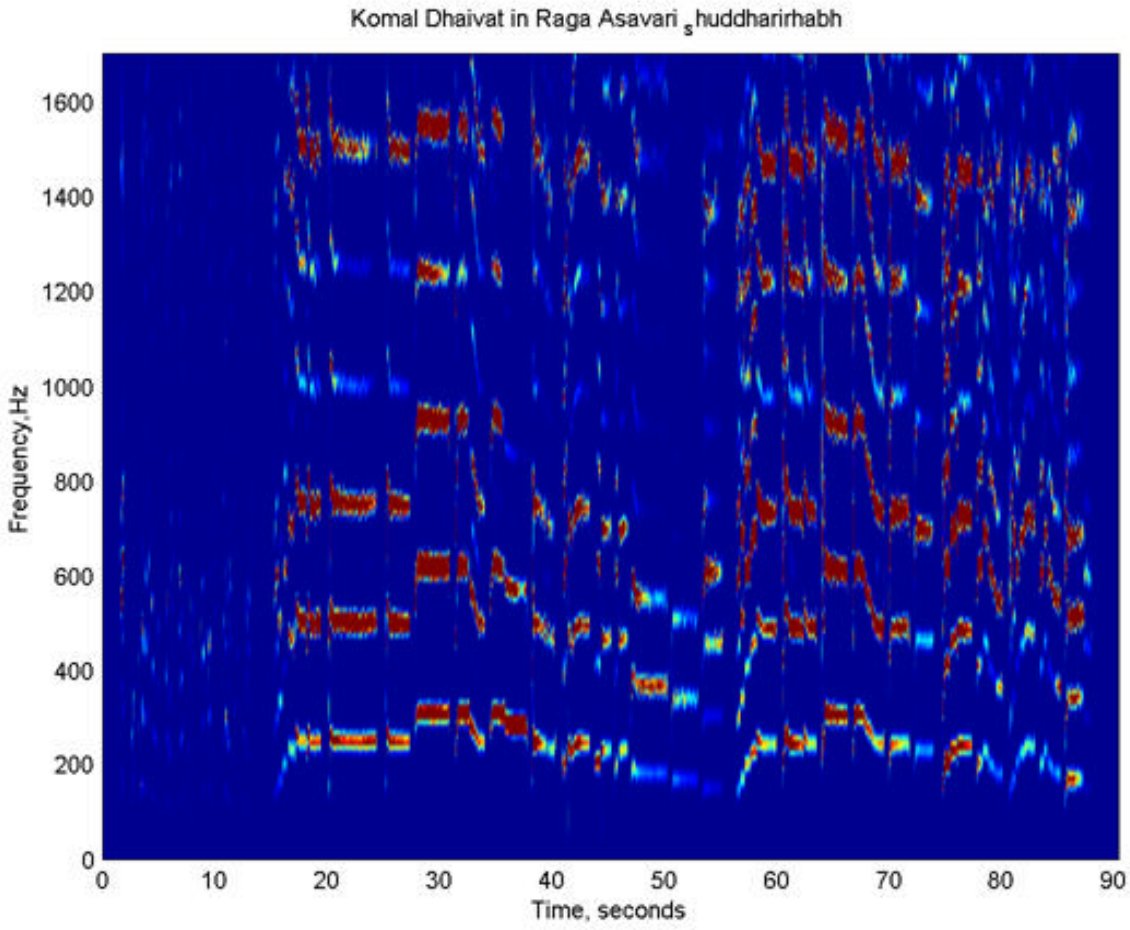
Frequency obtained from computer:-

komal dhaivat	495 – 506	Dr Oak' table	497 – 518
komal gandhar	356 -		368
komal nishad	560 – 570		560


Frequency Spectrum for Komal Dhaivat in Raga Asavari_s huddharirhabh
Energy
Frequency, Hertz
0
50
100
150
200
250
300
350
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Gandhar in Raga Asavari shuddharirhabh
Energy
Frequency, Hertz
0
20
40
60
80
100
120
140
160
180
200
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Nishad in Raga Asavari_s huddharirhabh
Energy
Frequency, Hertz
0
50
100
150
200
250
300
200
250
300
350
400
450
500
550
600
650
700


Komal Dhaivat in Raga Asavari $_s$huddharirhabh
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
Time, seconds

Raga Darbari kanada :-

In this raga gandhar, dhaivat and nishad are komal . All other swara are shuddha . In Aroh rishabh and dhaivat are dropped

jati :- sampurna

vadi:- rishabh Sanvadi :- pancham

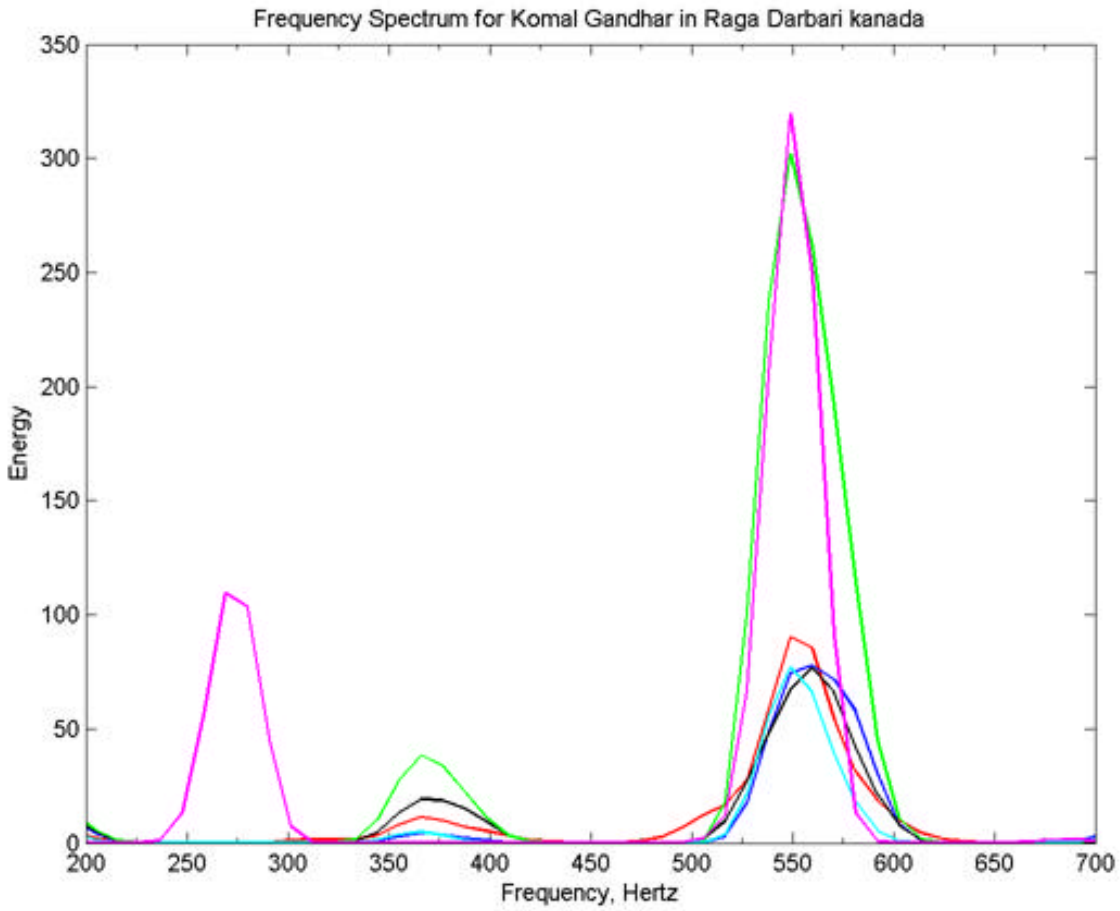
Time :- 10pm to 12 pm

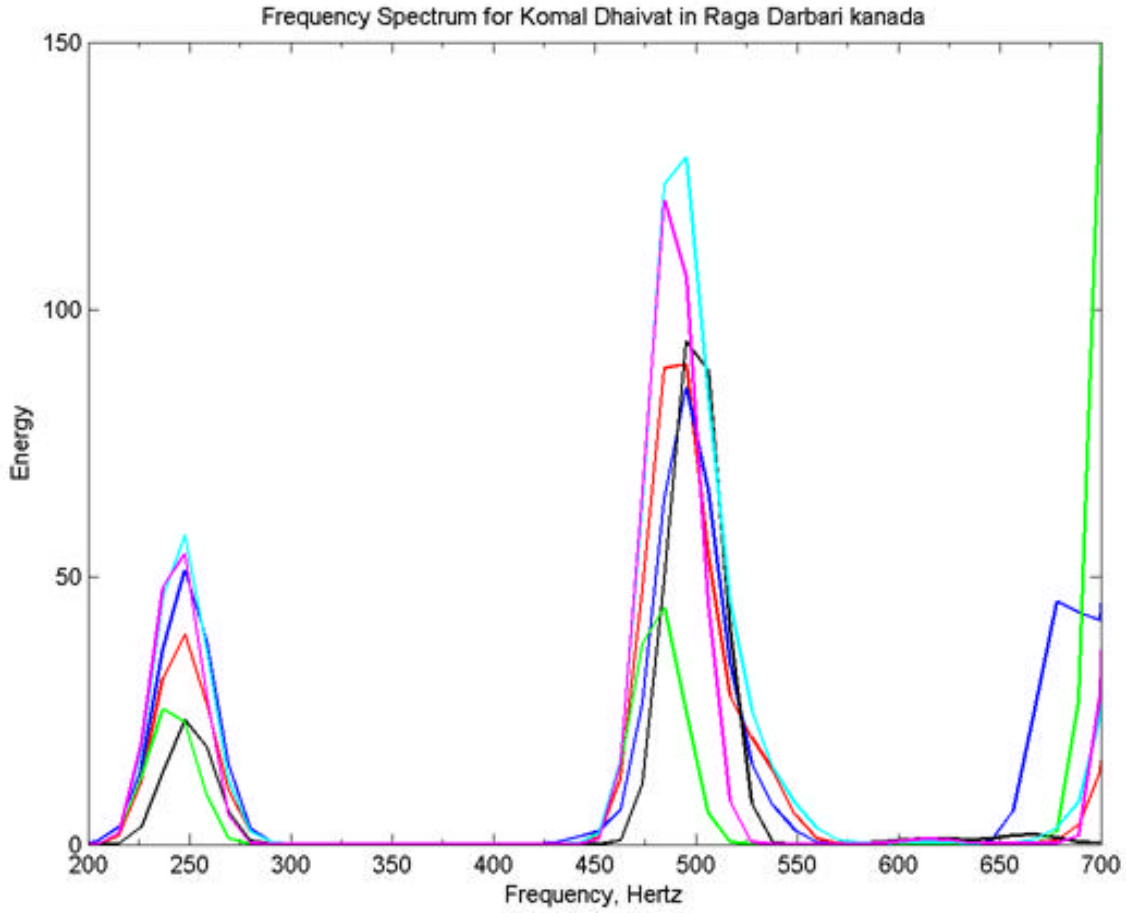
Deejen :-mee, j, ce ie ce ie ce he eve Oe eve Oe mee eve mee
DeJejen :- mee eve Oe eve Oe he ce he ce ie ce jmeeevemee j mee

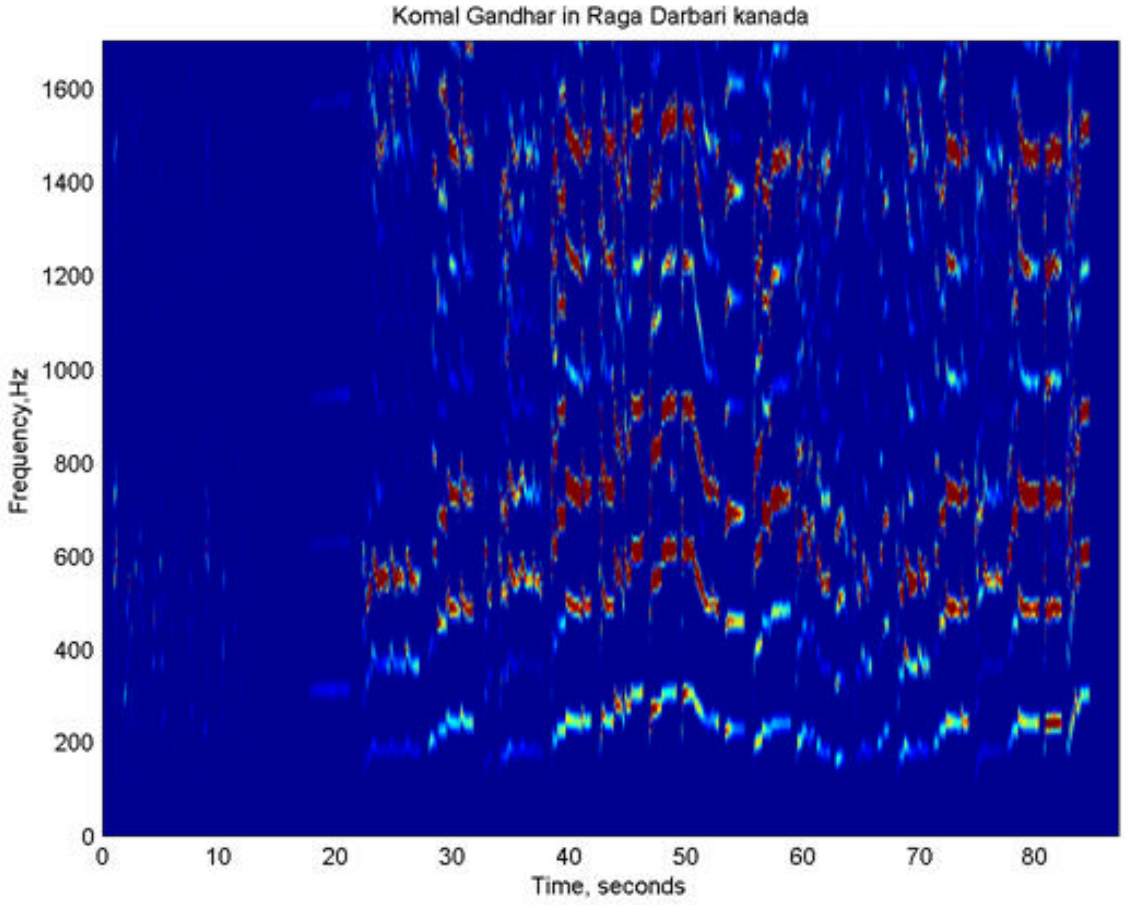
This raga is of Asavari anga and is of serious mood. Normally this raga is expressed in madhy and mandra saptak. Komal gandhar and komal dhaivat are andolit. In this raga while taking tan shadow of sarang raga is created.

Frequencies obtained from computer: -

Komal gandhar :- 366 to 370	Dr Oak's table	368 to 373
Komal dhaivat :- 480 to 485		491
Komal nishad :- 530 to 540		553


Frequency Spectrum for Komal Gandhar in Raga Darbari kanada
Energy
Frequency, Hertz
350
300
250
200
150
100
50
0
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Dhaivat in Raga Darbari kanada
150
100
50
0
Energy
200
250
300
350
400
450
500
550
600
650
700
Frequency, Hertz


Komal Gandhar in Raga Darbari kanada
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
Time, seconds

Raga Bhimpalas :-

In this raga gandhar and nishad are komal . All other swara are shuddha . In Aroh rishabh and dhaivat are dropped

jati :- odav sampurna

vadi:- madhyam Sanvadi :- shadja

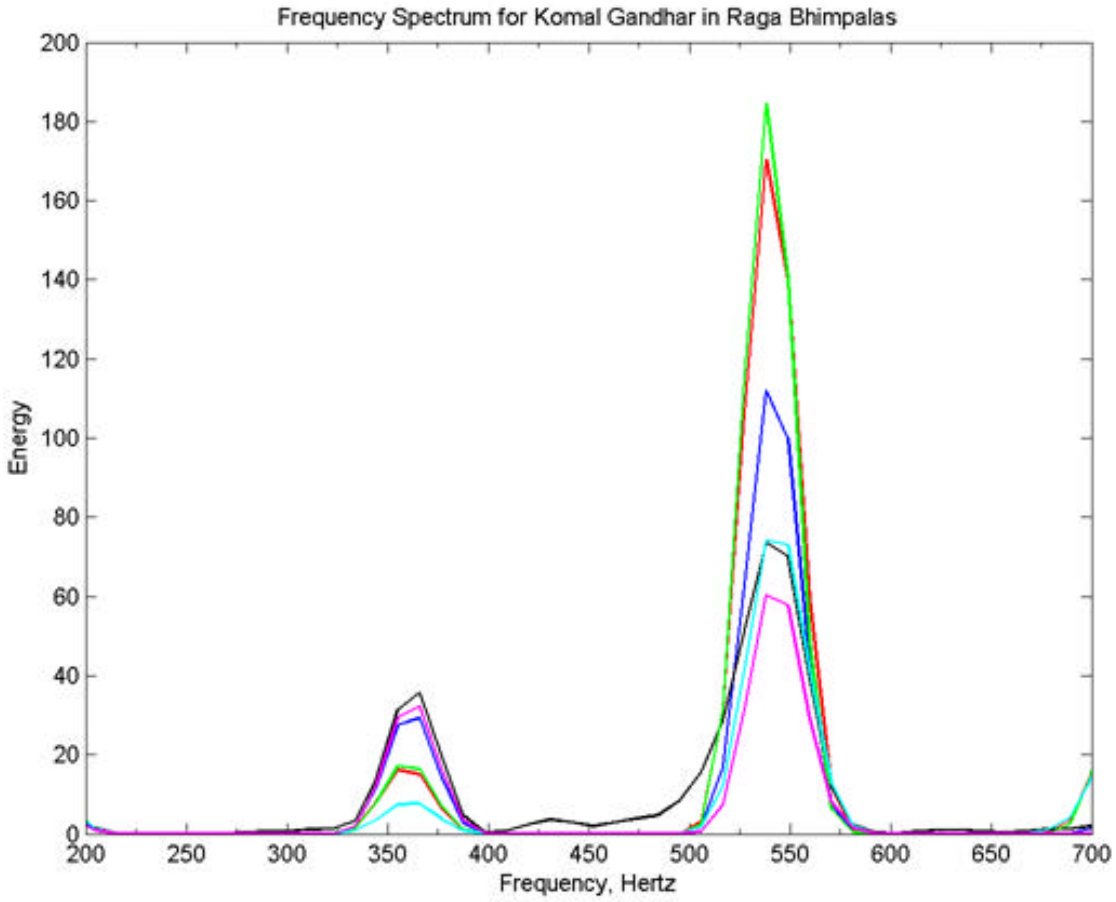
Time :- 1pm to 4pm

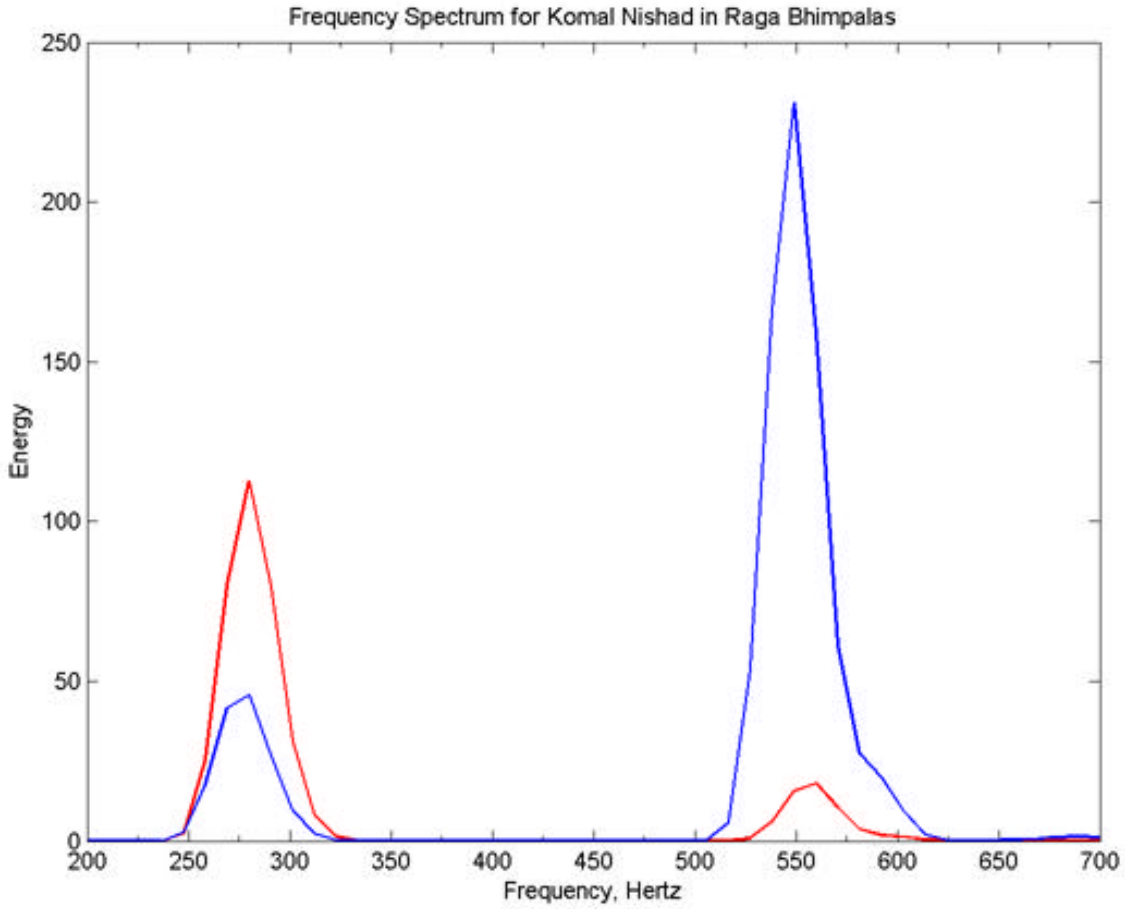
Deejen :- eve mee ce ie ce he eve mee
DeJejen :- mee eve Oe he ce he ce ie ce ie j mee

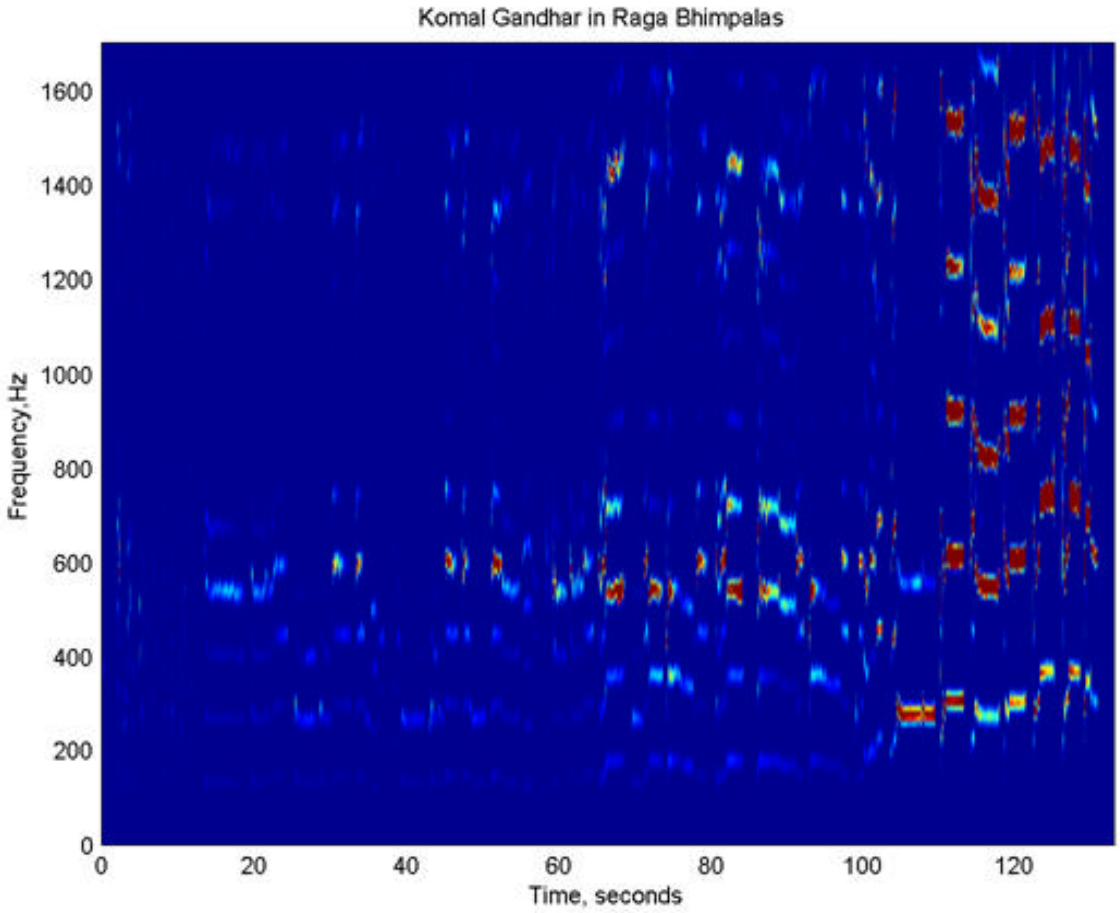
This raga is of kafi anga. In purvanga madhyam and in uttarang pancham swar are prominent.

Frequencies obtained from computer:-

Komal gandhar :- 366 to 375	Dr. Oak's table	368 to 373
Komal nishad :- 550 to 560		353 to 560


Frequency Spectrum for Komal Gandhar in Raga Bhimpalas
Energy
Frequency, Hertz
0
20
40
60
80
100
120
140
160
180
200
200
250
300
350
400
450
500
550
600
650
700


Frequency Spectrum for Komal Nishad in Raga Bhimpalas
Energy
Frequency, Hertz
250
200
150
100
50
0
200
250
300
350
400
450
500
550
600
650
700


Komal Gandhar in Raga Bhimpalas
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
Time, seconds

Raga Hameer :-

In this raga shuddha and tivra madhyam are used. In Aroh pancham is dropped.

jati :- shadav sampurna

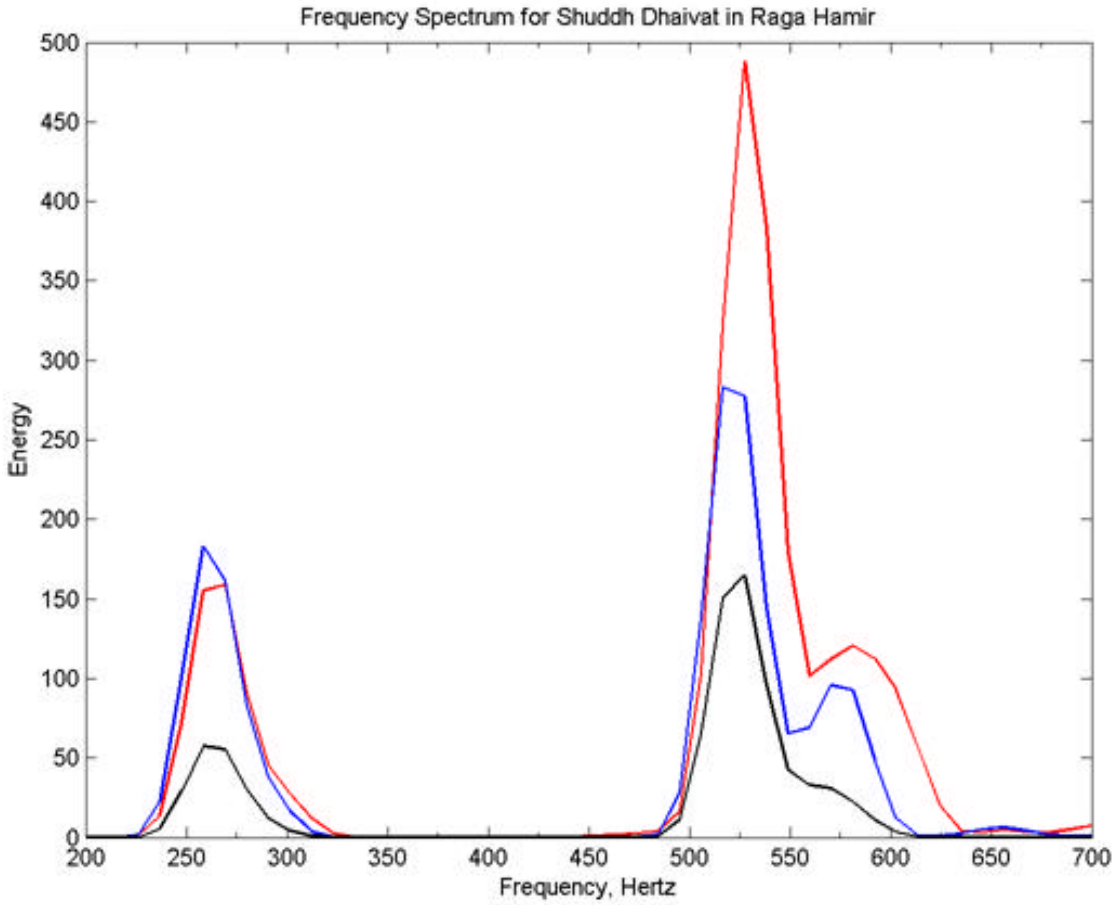
Vadi:- dhaivat Sanvadi :- Gandhar

Deejen :- mee, j , ie, ce eve Oe eve mee
DeJejen :- mee, eve, Oe, he, ce, ie, j, mee

This raga is of kalyan anga. If pancham swar is to be taken then from tivra madhyam alap or tan should be started. Shuddha dhaivat touches nishad.

Frequencies obtained from computer:-

Shuddha dhaivat :- 527 Dr. Oak's table 525


Frequency Spectrum for Shuddh Dhaivat in Raga Hamir
Energy
Frequency, Hertz
500
450
400
350
300
250
200
150
100
50
0
200
250
300
350
400
450
500
550
600
650
700

Raga Bhoop :-

In this raga all swaras are shuddha. madhyam and nishad are dropped.

jati :- Odav

Vadi:- Gandhar Sanvadi :- Dhaivat

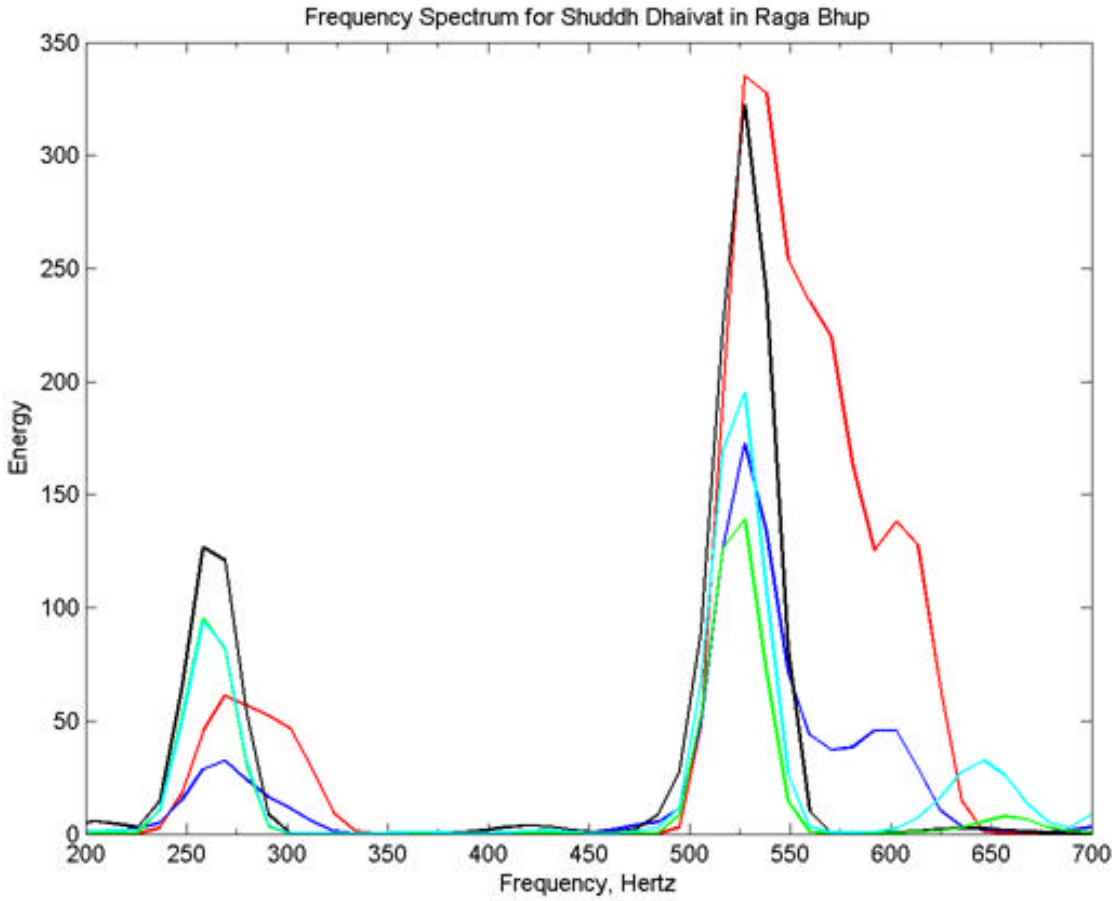
Time:- 7pm to 10pm

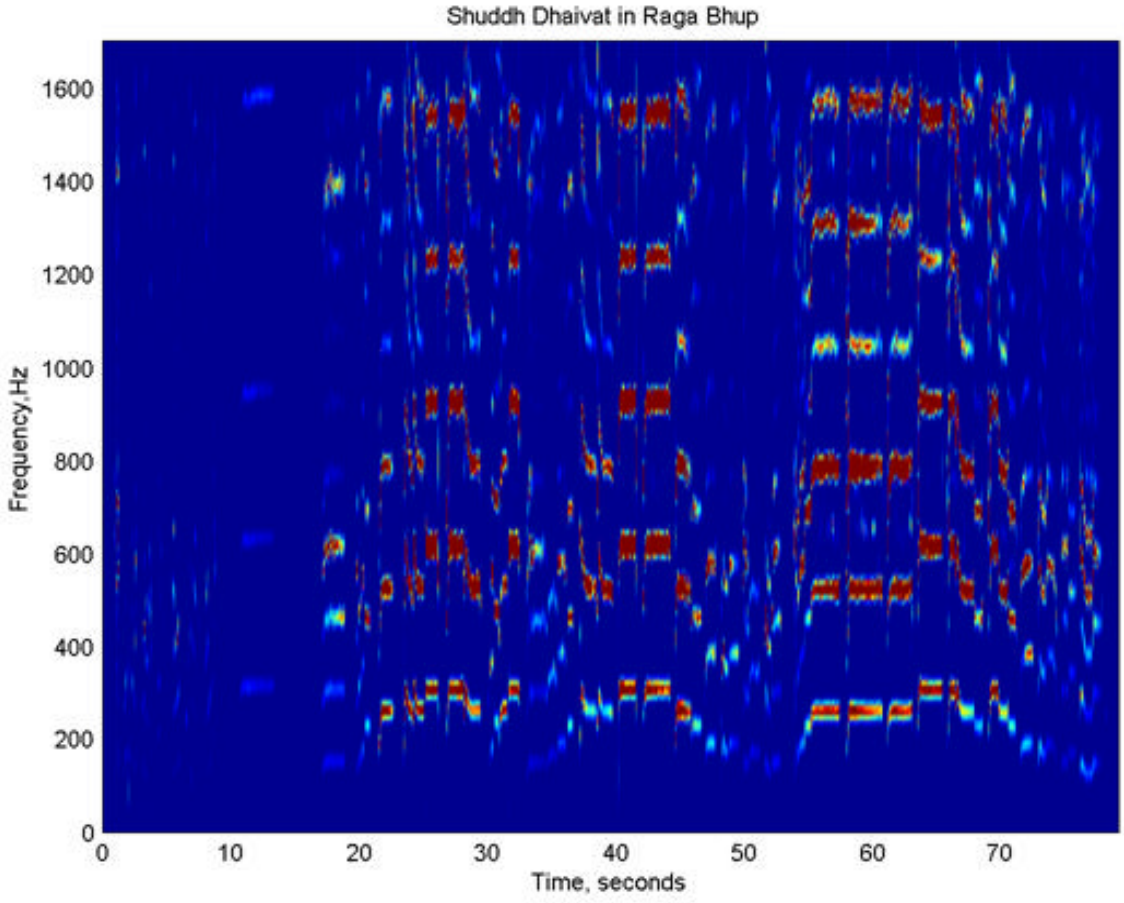
Deejen :- mee ie j ie he meeOe mee
DeJejen :- mee mee Oe he he ie j mee Oe mee Oe mee

This raga is of kalyan anga. In this raga nyas is on gandhar and rishabh. This rag is purvanga pradhan and of shanta rasa.
In this raga dhaivat goes near to shadja and gandhar goes to pancham.

Frequencies obtained from computer:-

Shuddha dhaivat :- 517 to 527 Dr. Oak's table 525


Frequency Spectrum for Shuddh Dhaivat in Raga Bhup
Energy
Frequency, Hertz
0
50
100
150
200
250
300
350
200
250
300
350
400
450
500
550
600
650
700


Shuddh Dhaivat in Raga Bhup
Frequency,Hz
1600
1400
1200
1000
800
600
400
200
0
0
10
20
30
40
50
60
70
Time, seconds

SWARA AND FREQUENCY

Raga	Swara	Frequency
Todi	Komal Rishabh	323-330
Multani	Komal Rishabh	312-323
Marava	Komal Rishabh	333
Todi	Tivra Madhyam	450-453
Multani	Tivra Madhyam	430-441
Yaman	Tivra Madhyam	430
Marava	Tivra Madhyam	450-460
Todi	Komal Gandhar	366-376
Multani	Komal Gandhar	366
Darbari Kanada	Komal Gandhar	366-370
Asavari	Komal Gandhar	366
Bhimpalas	Komal Gandhar	366-375
Bageshri	Komal Gandhar	355-360
Todi	Komal Dhaivat	500
Multani	Komal Dhaivat	494-495
Asavari	Komal Dhaivat	495-506
Darbari Kanada	Komal Dhaivat	480-485
Marava	Shuddha Dhaivat	560
Bhup	Shuddha Dhaivat	517
Hamir	Shuddha Dhaivat	517-527

Yaman	Shuddha Dhaivat	506-516
Asavari	Komal Nishad	560-570
Bhimpalas	Komal Nishad	550
Bageshri	Komal Nishad	540-555
Darbari Kanada	Komal Nishad	540-550

Conclusion

Importance of swara in Bharatiya sangit:-

The medium of music is sound. The sound with uniform frequency is called musical sound or 'Nada'

The music is a language of notes or swaras and every note or swara is nada of soul.

The continuous series of sound wave of same pitch, which is melodious and gives aesthetic joy is called 'SWARA'. Pitch represents the perceived fundamental frequency of sound.

The various melodious permutations and combination of swars are used to create different expressions, moods, rasa and bhava (emotions).

The swars should be properly placed (swaracha lagav) to achieve expected rasa, bhava, and melody while presenting raga. If the placement of swara is slightly deviated then the presentation goes out of tune. Therefore swara has got extreme importance in North Indian classical music.

A treatise, a lecture or an article on music or mathematical presentation by musicologists may satisfy mentally but can not emotionally.

Sthan of swaras in Bharatiya sangit

1) Consonance of swara :- In Bharatiya sangit sthan of all swaras is based on swaragati shruties, which provide sanvad or consonance. Sthan of all swaras either in our normal scale (saptak) or in Raga, is based on 1) Shadja – Pancham bhav, (2:3)
   2) Shadja – Madhyam Bhav (3:4)
   3) Shadja – Gandhar bhav. (4:5)

2) Time theory :- The intensity of sun rays affects the metabolism of the human body. Thus it affects the moods of human being too. Swaras suitable for the particular period are used while singing.

3) The combination of swaras in ‘aroh’ and ‘avaroha’ fixes sthan of particular swara

4) Consonance of other swaras with ‘vadi’ and ‘sanvadi’ of raga fixes the sthan of swaras

5) Nyas is responsiblefor fixing the sthan of swara in raga.

6) The structure of raga (swarup) like ‘badhat’, scale, mood etc are responsible for fixing the sthan of a swara

Sthan of swara also depends upon the personality of the artist.

7) Bhav : Emotional exprestions of raga decides the sthan of swara

8) Words Bandish :- According to meaning of words of the bandish swara should be applied which fixes the sthan of swara

9) Sthan of swara depends on the personality of the artist. It fixes the limits of the consonance and harmonics combination.

10) Mental condition of the artist

11) Vocal cord of the artist.

12) Raganga of Raga.

13) Types of shruti jati.

All above mentioned factors are responsible for fixing sthan of swara, Therefore the sthan of swara is different in different ragas.
This can be proved quantitavely.

Objective

I feel these findings will be useful to the teacher, students and artistes, while teaching or presenting the music.

I will help them to understand the proper application of swara at proper sthan to achieve rasa, emotions(bhava), mood and melody while presenting music.

It will enhance the aesthetic sense of music. The artiste and the listeners will get engrossed, forget all other things except music which is BRAHMANAND!

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