

An Analytical Study –‘The Contribution of Mathethatics numerical numbers, structure, space in developing music’

(In Special context of Indian Classical Music)

Music is organized sound. The **Concise Oxford Dictionary** defines music as "the art of combining vocal or instrumental sounds (or both) to produce beauty of form, harmony and expression of emotion" ¹

Indian classical music is a genre of south Asian music. It has two major traditions. The North Indian classical music tradition is called *Hindustani*, while the South Indian expression is called *Carnatic*.² these traditions were not distinct till about the 16th century. There on, during the turmoil's of Islamic period of the Indian subcontinent, the traditions separated and evolved into distinct forms. However, the two systems continue to have more common features than differences.³

The roots of the classical music of India are found in the vedic literature of hinduism and the ancient Granth Natyashastra, the classic Sanskrit text on performance arts by Bharata Muni. The 13th century Sanskrit text *Sangita-Ratnakara* of Sarangadeva is regarded as the definitive text by both the hindustani music and Cranatic music Traditions.⁴

The Indian classical music has two foundational elements, *raga* and *tala*. The Raga forms the fabric of a melodic structure, the tala measures the time cycle.⁵ The *raga* gives an artist the ingredients palette to build the melody from sounds, while the *tala* provides them with a creative framework for rhythmic improvisation using time. In Classical music has many gayan shellies like Dhruvad,Dhamar Khayal,Thumari,Sargamgeet,Lakshangeet,Tarana etc but Dhruvad gayan shelly are among the oldest classical Indian music.⁶

In Indian classical foundation music, there are three major elements-Swar,Laya,Tala⁷

Swar is a tone,it has special features like echo, stillness, beauty. Swar produce with the help of laya and **laya** is the unit of tala. **Tala** is the major element of rhythm and without help of beat; we can't produce any types of music composition. Music is totally connective with mathematics forms and numerical signs. Mathematics is the study of topics such as **quantity (numbers), structure, space, and change**.⁸ in composition, tala describes his major role to be introducing and producing music. Notation has mathematics numbers to be clear and explain the music theory.⁹

Indian Musical Fundamental Study

A. Swara -

Svara (Hindi स्वर), also spelled swara, is a Sanskrit word that connotes a note in the successive steps of the octave. More comprehensively, it is the ancient Indian concept about the complete dimension of musical pitch.

The svara differs from the sruti concept in Indian music. A sruti is the smallest gradation of pitch that a human ear can detect and a singer or instrument can produce. A svara is the selected pitches from which the musician constructs the scales, melodies and ragas. The ancient Sanskrit text Natya Shastra identifies and discusses twenty two sruti and seven svara. The svara studies in ancient Sanskrit texts include the musical gamut and its tuning, categories of melodic models and the raga compositions.

The seven notes of the musical scale in Indian classical music are shadja (षड्ज), rishabh (ऋषभ), gandhar (गान्धार), madhyam (मध्यम), pancham (पञ्चम), dhaivat (धैवत) and nishad (निषाद). These seven svara are shortened to Sa, Ri (Carnatic) or Re (Hindustani), Ga, Ma, Pa, Dha, and Ni. Collectively these notes are known as the sargam.¹¹

Shudh Swar	7
Komal Swar Flat rekha under the Komal Swar	4 <u>Re Ga Dha Ni</u>
Tivar Swara Standing Rekha upper the Tivar Swar	1 1 Ma

Total Swara-12

Saptak (Octave)

Mander Saptak	Madya Saptak	Taar Saptak
Dot under the Swar	No Sign	Dot Upper the Swar

Taan

EkGugn/ Dhogun/ Chargun	SaSa/ReRe/GaGa —	—
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Meend sign- ^ ^

—	—	—
SaPa	RePa	PaGa

Khatka sign is (SA), (MA)

Aarohi Khatka (Sa) = NiSaReSa 1/4	Avrohi Khatka (Ma) = PaMaGaMa 1/4
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B. Alankar Some decided Varna combinations are called as Alankar. The meaning of Alankar is ornament. Like ornament enhances physical grace in the same way with Alankar there is a grace in singing. Alankar is also called as Palta. In the initial stage of learning Hindustani Classical Music students are primarily taught Alankar, because without Alankar student cannot acquire good swar knowledge and neither he can get ascendancy in Indian classical music. With Alankar we also get help in Raag Vistar. A raag can also be decorated with the help of Alankar. Taan etc are also made with the help of Alankar. Therefore Alankar's are practice to gain swar gyan (knowledge) and to improve vocal abilities. For example: Sa Re Ga, Re Ga Ma, etc.

If we start making Alankar with the first step as (Sa Re Ga) then the second step will be (Re Ga Ma) and then the third step will be (Ga Ma Pa) and it goes on till it ends at Taar Saptak Sa to complete it Aaroh.

Similarly the first step for the avroh will be (Ś ni dha) and the second step will be (Ni Dha Pa) and then the third step will be (Dha Pa Ma) and it goes on till it ends Madhya Saptak Sa. similarly the first step for the avroh will be (Ś ni dha) and the second step will be (Ni Dha Pa) and then the third step will be (Dha Pa Ma) and it goes on till it ends Madhya Saptak Sa.

In this way 100s and 1000s of Alankars can be made.

Alankars can also be made by including Komal and Tivra Swars but we have to be careful that we have to use only those swaras that are present in that particular Raag, for the Raag which we are making the Alankar. Follows some basic alankars-

Sapat Alankar- Sa Re Ga Ma Pa Dha Ni Sa - Sa Ni Dha Pa Ma Ga Re Sa **1/1**

Ghamak Alankar- SaSa ReRe GaGa MaMa PaPa DhaDha NiNi SaSa - SaSa NiNi DhaDha PaPa MaMa GaGa ReRe SaSa **1/2**

Baradte

Alankar-

SaReGa,ReGaMa,GaMaPa,MaPaDha,PaDhaNi,DhaNiSa-

SaNiDha,NiDhaPa,DhaPaMa,PaMaGa,MaGaRe,GaReSa 1/3 etc

C. Notation System- Indian classical music is both elaborate and expressive. Like Western classical music, it divides the octave into 12 semitones of which the 7 basic notes are, in ascending tonal order, Sa Re Ga Ma Pa Dha Ni for Hindustani music and Sa Ri Ga Ma Pa Dha Ni for Carnatic music, similar to Western music's Do Re Mi Fa So La Ti. However, Indian music uses just-intonation tuning, unlike most modern Western classical music, which uses the equal-temperament tuning system. Also, unlike modern Western classical music, Indian classical music places great stress on improvisation. The underlying scale may have four, five, six or seven tones, called swaras (sometimes spelled as svaras). The svara concept is found in the ancient Natya Shastra in Chapter 28. It calls the unit of tonal measurement or audible unit as Śhruti.

तत्र स्वराः –

षड्जश्च ऋषभश्चैव गान्धारो मध्यमस्तथा ।

पञ्चमो धैवतश्चैव सप्तमोऽथ निषादवान् ॥ २१ ॥ — Natya Shastra, 28.21[81][82]

These seven degrees are shared by both major raga system, that is the North Indian (Hindustani) and South Indian (Carnatic)The solfege (sargam) is learnt in abbreviated form: sa, ri (Carnatic) or re (Hindustani), ga, ma, pa, dha, ni, sa. Of these, the first that is "sa", and the fifth that is "pa", are considered anchors that are unalterable, while the remaining have flavors that differ between the two major systems. Contemporary Indian music schools follow notations and classifications (see melakarta and thaata). These are generally based on a notation system created by Vishnu Narayan Bhatkhande.¹²

Jatti

Sampuran jatti	Shadhav jatti	Aodav jatti
7	6	5
Sampuran Sampuran jatti	Shadhav Shadhav jatti	Aodav Ahodav jatti
7x7	6x6	5x5
Sampuran Shadhav jatti	Shadhav Sampuran jatti	Aodav Sampuran jatti
7x6	6x7	5x7
Sampuran Aodav jatti	Shadhav Aodav jatti	Aodav Shadhav jatti
7x5	6x5	5x6



Total Jattiyaan-3x3=9

Shruti

Sa	Re	Ga	Ma	Pa	Dha	Ni
4	3	2	4	4	3	2

Total Shruti=22

Murchanna

Mandhara Sapak	Madhya Saptak	Tar Sapak
7	7	7

Total Murchanna=21

Indian Music Tala Signs

Sum is a starting point .Sign is **x**.

Khali is an empty point. Sign is **o**.

Matra is Unit numbers of Tala Sign is -1, 2, 3,

Vibhag is divided counting number. Sign is- I I I I ¹³

Taal Parkaran¹⁴

Taal -Teentaal

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dha	Dhin	Dhin	Dha	Dha	Dhin	Dhin	Dha	Dha	Tin	Tin	Ta	Ta	Dhin	Dhin	Da
X				2				0				3			

Taal -Kehrawa

1	2	3	4	5	6	7	8
Dha	Gha	Na	Ti	Na	Ke	Dhin	Na
x				o			

Taal- Dadra¹⁵

1	2	3	4	5	6
Dha	Dhin	Na	Dha	Tin	Na
x			o		

CONCLUSION

By default, it is a fact that to learn anything in music is as easy. Education way is totally depend upon the Notation System .Worldwide country music is composed in Notation system and Notation system is based on Mathematics Numerical numbers and space. In Special context of Indian Classical Music is connected with Notation Theory in which all Mathematics Numbers are required for the development of great music.

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