Semester: VII					
MATHEMATICS OF MUSIC Category: Institutional Elective – II (Group G) (Theory)					
Course Code	:	MA375TGR		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45L		SEE Duration	:	3 Hours

Unit-I	09 Hrs

Fundamentals of Sound and Musical Structure

Nature of sound: frequency, amplitude, harmonics, waveforms; Musical pitch and logarithmic perception of frequency, Shruti, Swara, Saptak; Musical notation systems.

Unit – II	09 Hrs

Tuning Systems and Modular Arithmetic in Music

Pythagorean tuning, Just Intonation, and Equal Temperament, Circle of Fifths and the irrationality of $\log(3/2)$, Modular arithmetic and pitch class sets, Construction of scales: Melakarta Rāga(Carnatic) and Thaat (Hindustani) systems.

Unit –III	09 Hrs

Rhythm, Tāla, and Combinatorial Structures

Tāla systems: concepts of mātra, vibhāga, āvartana; Analysis of Carnatic tālas (Adi, Rupaka, Jhampa, etc.); Combinatorics of tāla patterns and variation (korvais, tihāis); Algorithmic composition of rhythmic phrases

Unit –IV	09 Hrs

Timbre, Music Analysis and Processing

Timbre and harmonic spectra, Fourier series and transforms in sound decomposition, Sub-harmonics, Limitation of Fourier Analysis: Noise; Introduction to sound synthesis and spectral envelopes.

Unit –V	09 Hrs

Algorithmic Music and Perception

Fractals and recursion in music, Algorithmic and generative composition, Mathematical models of musical perception, Psychoacoustics: pitch, consonance/dissonance, critical bands.

Course Outcomes

CO1	Analyze musical phenomena using mathematical tools
CO2	Model rhythm, harmony, and timbre using algebraic and computational methods.
CO3	Apply signal processing concepts to sound synthesis and analysis.
CO4	Explore algorithmic and generative approaches to musical composition.

Reference Books	
1.	Benson, D. J. (2006). *Music: A Mathematical Offering*. Cambridge University Press, ISBN: 978-0521619998.
2.	Fauvel, J., Flood, R., & Wilson, R. (Eds.). (2003). *Music and Mathematics: From Pythagoras to Fractals*. Oxford University Press, ISBN: 978-0199298938.
3.	Loy, G. (2006). *Musimathics: The Mathematical Foundations of Music* (Vol. 1 & 2). MIT Press, ISBN: 9780262516556.
4.	Sethares, W. A. (2005). *Tuning, Timbre, Spectrum, Scale* (2nd ed.). Springer, ISBN: 978-1852337971.
5	*Radhika Iyer (2018), Elements Of Indian Music: The Melakarta System,* ISBN: 1513460854.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

Artificial Intelligence and Machine Learning