RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

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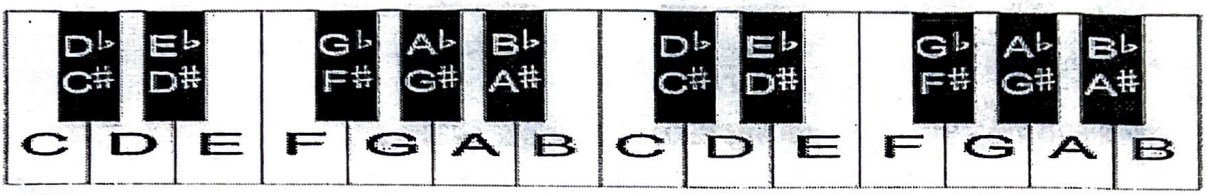
Date: 07-10-2025	CIE 1	Max. Marks: 10+50
Semester: VII	UG	Duration: 2 Hrs (1:20PM- 3:20PM)
Course Title: Mathematics of Music		Course code: MA375TGR

Department of Mathematics



S No	Quiz	M	BT	CO
1.	Define frequency and state its unit of measurement.	1	1	1
2.	What is the frequency ratio of an octave?	1	1	1
3.	A sound wave has an intensity of $I = 10^{-7}\, W/m^2$. Find its sound level in decibels, show the calculation.	2	2	2
4.	State the differences between Shruti and Swara.	2	3	3
5.	What is the perfect fourth ratio in Just Intonation? Also, express it in cents.	2	2	3
6.	What are harmonics? Give an example for a fundamental frequency of 100 Hz.	2	2	2

S No	Test	M	BT	CO
1a	A sound wave is represented by the equation: $p(t) = 0.2 \sin(2\pi \times 880t)$ Calculate the following: i. Frequency of the sound wave ii. Period of oscillation iii. Wavelength (given speed of sound v = 343 m/s) iv. Time taken for 50 complete oscillations	6	2	1
1b	Explain the relationship between frequency and perceived pitch. Why is pitch perception logarithmic rather than linear?	4	1	2

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<table>
<tr><td>2a</td><td>Write down all the swaras in a) Carnatic system b) Hindustani system</td><td>5</td><td>3</td><td>2</td></tr>
<tr><td>2b</td><td>If Sa (Shadja) = 240 Hz, calculate the frequencies of the following swaras using just intonation ratios: (5 marks)
<table>
<tr><th>Swara</th><th>Ratio</th><th>Frequency</th></tr>
<tr><td>Sa</td><td>1:1</td><td>?</td></tr>
<tr><td>Ri</td><td>9:8</td><td>?</td></tr>
<tr><td>Ga</td><td>5:4</td><td>?</td></tr>
<tr><td>Pa</td><td>3:2</td><td>?</td></tr>
<tr><td>Ni</td><td>15:8</td><td>?</td></tr>
</table>
Verify that Sa' (upper octave) = 2 × Sa.</td><td>5</td><td>2</td><td>3</td></tr>
<tr><td>3</td><td>Starting from C, show the ratio and cents calculations for all the notes of the C major scale in Pythagorean tuning (i.e., C, D, E, F, G, A, B).</td><td>10</td><td>3</td><td>4</td></tr>
<tr><td>4a</td><td>A ‘C major 7th’ chord {C, E, G, B} is represented as {0, 4, 7, 11}. Transposing up a perfect fourth (5 semitones) gives:
$T_5(\{0,4,7,11\}) = \{5,\_,\_,\_\} = \{F,\_,\_,\_\}$</td><td>6</td><td>2</td><td>3</td></tr>
<tr><td>4b</td><td>Write a note on Saptak in Indian classical music.</td><td>4</td><td>1</td><td>1</td></tr>
<tr><td>5</td><td>Derive the equal temperament semitone ratio starting from first principles. Calculate the frequencies of the following notes in 12-tone equal temperament, given $A_4 = 440$ Hz:
i) $A\#_4$ ii) C_5 iii) E_5 iv) A_5 v) B_5 vi) D_6</td><td>10</td><td>4</td><td>4</td></tr>
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