SYSTEM OF TRANSLITERATION

अ आ इ ई उ ऊ ए ऐ ऒ
a a i i u u r r l e a i

ओ ओ औ
o au m h

क क ख ग घ ङ
k kh g gh n

च छ ज झ
c ch j jh n

t ठ ड ढ ठ
t th d dh n

त थ द ध

p फ ब भ म

य र ल व श ष च छ
# APPENDIX 1

## Saskrit Speech Sounds

<table>
<thead>
<tr>
<th></th>
<th>Vowels (21+2)</th>
<th>Sparsās (25)</th>
<th>Semi-vowels (4)</th>
<th>Fricatives (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velars</td>
<td>a,  ā, a3</td>
<td>k, kh, g, gh,</td>
<td></td>
<td>h(?) glottal</td>
</tr>
<tr>
<td>Palatals</td>
<td>i, ī, i3</td>
<td>c, ch, j, jh,</td>
<td>y</td>
<td></td>
</tr>
<tr>
<td>Retroflexs</td>
<td>r, r̄, 0</td>
<td>t, th, d, dh,</td>
<td>r</td>
<td>s</td>
</tr>
<tr>
<td>Dentals</td>
<td>l, ī, 0</td>
<td>t, th, d, dh,</td>
<td>l</td>
<td>s</td>
</tr>
<tr>
<td>Labials</td>
<td>u, ū, u3</td>
<td>p, ph, b, bh,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palatovelars</td>
<td>e, e3,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ai, ai3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labiovelars</td>
<td>o, o3,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>au, au3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labiodental</td>
<td>h</td>
<td>k</td>
<td>v</td>
<td></td>
</tr>
</tbody>
</table>

Yamās = 4.
APPENDIX 2

Speech Materials of the Pilot Study

I List of words

1. akati
2. akhandam
3. ajayyah
4. adagdhah
5. adhamah
6. adhakam
7. aparah
8. aphalam
9. amarah
10. racayati

II List of Sentences

1. akati uragah uvarake.
2. akhandam idam iranam.
3. ajayyah esah uma.
4. adagdhah chayam ikatah.
5. adhamah udham chalayati.
6. adhakam nayami akham.
7. aphalam kavyam racayati.
8. aparah balakah vadati.
9. amarah osam edhate.
10. racayati kavyam saphalam.
APPENDIX 3

Speech Materials for the Main study

List of words:

1. akati = moves
2. akhandam = unbroken (vast)
3. ajayyah = unconquerable
4. atha = thus
5. adagdah = not burnt
6. adhamah = bad man
7. aparam = another
8. aphalah = fruitless
9. amarah = immortal
10. ayathā = improper, false
11. aranye = in the forest
12. alam = enough
13. avati = protects
14. asaktah = unable
15. asati = shines
16. asatyam = untrue
17. aham = I, me
18. ākarah = source
19. āksena = with the spade
20. ājakam = a flock of goats
21. ādambarah = show
22. ādhakam = a measure of grain
23. ādatte = receives, takes
24. ādhatte = keeps
25. ṛpati = gets
26. āphalakam = enclosure
27. āmantritah = invited
28. āyatam = ten finger long
29. ārambhe = in the beginning
30. ālasaḥ = lazy man
31. āveyoh = both of us
32. āsa = desire
33. āsāde = in the month of āsāde
34. āsanam = chair
35. āharati = brings
36. ikatah = stick of a bamboo
37. idam = this
38. imathā = this way
39. iyam = this girl
40. iranam = desert
41. ilati = moves
42. iva = like
43. isayati = wishes
44. igha = here
45. Idañam = praising
46. Iranah = wind
47. ḳaṣaḥ = master
48. Thate = desires
<table>
<thead>
<tr>
<th>No.</th>
<th>Word</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.</td>
<td>ukhe</td>
<td>in the vessel</td>
</tr>
<tr>
<td>50.</td>
<td>udakām</td>
<td>water</td>
</tr>
<tr>
<td>51.</td>
<td>upari</td>
<td>above the town</td>
</tr>
<tr>
<td>52.</td>
<td>ume</td>
<td>in the town</td>
</tr>
<tr>
<td>53.</td>
<td>urname</td>
<td>snake, serpent</td>
</tr>
<tr>
<td>54.</td>
<td>ulapah</td>
<td>creeper</td>
</tr>
<tr>
<td>55.</td>
<td>varake</td>
<td>store room</td>
</tr>
<tr>
<td>56.</td>
<td>usattamaḥ</td>
<td>most beautiful</td>
</tr>
<tr>
<td>57.</td>
<td>ākasya</td>
<td>belonging to a bird</td>
</tr>
<tr>
<td>58.</td>
<td>usarajam</td>
<td>salt</td>
</tr>
<tr>
<td>59.</td>
<td>ādham</td>
<td>married person</td>
</tr>
<tr>
<td>60.</td>
<td>ādhanyām</td>
<td>milk</td>
</tr>
<tr>
<td>61.</td>
<td>āmah</td>
<td>friend</td>
</tr>
<tr>
<td>62.</td>
<td>āyate</td>
<td>weaves</td>
</tr>
<tr>
<td>63.</td>
<td>uravyena</td>
<td>by the merchant</td>
</tr>
<tr>
<td>64.</td>
<td>āsake</td>
<td>in the morning</td>
</tr>
<tr>
<td>65.</td>
<td>āhati</td>
<td>guesses</td>
</tr>
<tr>
<td>66.</td>
<td>pabham</td>
<td>bull</td>
</tr>
<tr>
<td>67.</td>
<td>ekatram</td>
<td>some where</td>
</tr>
<tr>
<td>68.</td>
<td>ejate</td>
<td>shines</td>
</tr>
<tr>
<td>69.</td>
<td>edakam</td>
<td>wild goat</td>
</tr>
<tr>
<td>70.</td>
<td>edhate</td>
<td>grows</td>
</tr>
<tr>
<td>71.</td>
<td>emah</td>
<td>way</td>
</tr>
<tr>
<td>72.</td>
<td>erakam</td>
<td>woolencarpet</td>
</tr>
<tr>
<td>73.</td>
<td>elayati</td>
<td>moves</td>
</tr>
<tr>
<td>74.</td>
<td>evam</td>
<td>like this</td>
</tr>
</tbody>
</table>
75. esah = he
76. aikah = one's
77. aidakam = wall
78. aidamparyam = this much
79. aiyatyam = this much
80. airam = heap
81. ailah = mars
82. aisamah = in this year
83. okasya = of the house
84. okhati = drys
85. ojati = remains strong
86. odanam = rice
87. opasah = pillow
88. omah = protector
89. olajjati = throws
90. osam = quickly
91. charah = tortoise
92. aujasam = golden
93. audah = wet
94. audakī = aquatic
95. audhasyasya = milk
96. aupamyam = resemblance
97. aurasah = son
98. ausanasah = son of Sukra
99. ausadham = medicine
100. chalayati = deceives
<table>
<thead>
<tr>
<th>No.</th>
<th>Word</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>chāyāyāṃ</td>
<td>in the shade</td>
</tr>
<tr>
<td>102</td>
<td>chinnā</td>
<td>spoiled</td>
</tr>
<tr>
<td>103</td>
<td>chātraḥ</td>
<td>student</td>
</tr>
<tr>
<td>104</td>
<td>dhakkā</td>
<td>drum</td>
</tr>
<tr>
<td>105</td>
<td>dhālam</td>
<td>shield</td>
</tr>
</tbody>
</table>
SENTENCES USED:

1. chaṭraḥ asatyaṁ ālapati.
2. edakah aranye ojati.
3. omah ājakaṁ āvati.
4. ayathā Īdanaṁ alam.
5. āsaktah udakaṁ āpati.
6. ailah ekatra āsati.
7. ākhena airaṁ olajjati.
8. uksya āsādhe ādambarah.
9. ayam āvayoḥ ākaraḥ.
10. iyaṁ odanaṁ ādatte.
11. okasya ādakāṁ āphalakaṁ.
12. ālasyah ausadham ādhatte.
13. āurvyena ayatam ūyate.
14. ukhe aiyatyam audhasyasya.
15. ulapah ārambhe okhati.
16. āśa imathā chinnā.
17. aujasaṁ āsanam āharati.
18. Iranaḥ upari ilati.
19. aurasaḥ erakam īsayati.
20. atha evaṁ emah.
21. āisamah ausanah uśattamah.
22. aikah opasah audah.
23. uṣake ūdhanyam pibāmi.
24. oharah audaki jantuh.
The order of the words in these sentences were changed to make 109 sentences.

* incorrectly used, as pointed out by examiner 2.
### APPENDIX 4

**Specifications for the Sound Spectrograph Series 700 VII**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrogram Paper Size</td>
<td>12 3/4&quot; 5 5/8&quot;: Display is 4 1/2&quot; high.</td>
</tr>
<tr>
<td>Analysis Segment</td>
<td>2.5 seconds of sound signal is analysed to 8000 Hz. in 80 seconds directly from magnetic tape with no intermediate recording necessary.</td>
</tr>
<tr>
<td>Time Axis</td>
<td>Horizontal axis represents 2.5 seconds at recording speed of 7.5 ips.</td>
</tr>
<tr>
<td>Frequency Axis</td>
<td>Represents 25 to 8000 Hz. with Logarithmic Scale.</td>
</tr>
<tr>
<td>Dynamic range</td>
<td>Better than 50 dB.</td>
</tr>
<tr>
<td>Calibration</td>
<td>Int. crystal oscillator provides marks at each 1 KHz point upto 8 KHz.</td>
</tr>
<tr>
<td>Equalization</td>
<td>Flat response optimized for speech (12 dB per octave), Boost between 300 to 3000 Hz.</td>
</tr>
<tr>
<td>Tape advance</td>
<td>Automatic, normally set at 2 seconds for contiguous speed.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>23&quot; high, 44&quot; wide, and 16&quot; deep, 140 lbs weight.</td>
</tr>
<tr>
<td></td>
<td>Shipping weight 250 lbs.</td>
</tr>
<tr>
<td>Power source</td>
<td>120 volts, 60 Hz AC Power, 240 volts, 50 Hz on special order, 300 watts nominal input power.</td>
</tr>
</tbody>
</table>
APPENDIX 5

(i) Spectrograms of Sanskrit speech sounds depicting their characteristics.
(a) Vowels
(b) Sparásts

\begin{align*}
\text{a} & \quad \text{a} \\
\text{a} & \quad \text{a}
\end{align*}

\begin{align*}
\text{C} & \quad \text{S} \\
5000 & \\
4000 & \\
3000 & \\
2000 & \\
1000 & \\
\text{K} & \\
\text{a} & \quad \text{kh} & \quad \text{a}
\end{align*}
(c) Semivowels
(d) Fricatives

\[
\begin{array}{c}
\text{a} \quad \text{s} \quad \text{a} \\
\text{s} \\
\text{a} \quad \text{s} \quad \text{a}
\end{array}
\]
(ii) Spectrograms of Sanskrit consonants whose characteristics were hypothesized.
A 5.13

jh a

a th a

a ta a

a ba a
(iii) Sections of vowels showing their formant frequencies

- C | S
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000

- a
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000

- i
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000

- a
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000

- i
(iv) Spectrograms validating

(a) Hypothesis 1

\[ F_2 |a| < F_2 |ai| < F_2 |e| < F_2 |i|, \]

\[ F_2 |au| < F_2 |o| < F_2 |u|. \]
(b) Hypothesis 2 and 4.

\[ F_1 |d| < F_1 |s| < F_1 |r| < F_1 |s'| \]
\[ F_2 |t_1| < F_2 |r| < F_2 |s| < F_2 |s'| \]

(c) Hypothesis 3.

\[ F_2 |i| > F_2 |y| > F_2 |s| > F_2 |s'\]
(d) Hypothesis 5

Nāda
(Samvāra) sound \( \eta \) showing voice bars and Śvāsa
showing a gap.

(e) Hypothesis 6

Alpāpraṇa sound \( k \) showing fewer fills than the mahāpraṇa
sound \( kh \).

K a
Slight Aspiration

kh a
Strong Aspiration
(v) Spectrograms of finger snap and burst of consonant [p]

Finger snap

Burst of [p]