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Final proposal to encode Nandinagari in Unicode

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Final proposal to encode Nandinagari in Unicode

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1 Introduction

This is a proposal to encode the Nandinagari script in Unicode. It supersedes the following documents:

- L2/13-002 “Preliminary Proposal to Encode Nandinagari in ISO/IEC 10646”
- L2/16-002 “Proposal to encode the Nandinagari script in Unicode”
- L2/16-310 “Proposal to encode the Nandinagari script in Unicode”
- L2/17-119 “Towards an encoding model for Nandinagari conjuncts”

It incorporates comments regarding previous proposals made in:

- L2/16-037 “Recommendations to UTC #146 January 2016 on Script Proposals”
- L2/16-057 “Comments on L2/16-002 Proposal to encode Nandinagari”
- L2/16-216 “Recommendations to UTC #148 August 2016 on Script Proposals”
- L2/17-153 “Recommendations to UTC #151 May 2017 on Script Proposals”
- L2/17-117 “Proposal to encode a nasal character in Vedic Extensions”

Major changes since L2/16-310 include:

- Expanded description of the headstroke and its behavior (see section 3.2).
- Clarification of encoding model for consonant conjuncts (see section 5.4).
- Removal of digits and proposed unification with Kannada digits (see section 4.9).
- Re-analysis of ‘touching’ conjuncts as variant forms that may be controlled using fonts.
- Removal of *ardhavisarga* and other characters that require additional research (see section 4.10).
- Identification of a *pr̥ṣṭhamātrā*, which is not included in the proposed repertoire (see section 4.10).
- Proposed reallocation of a Vedic nasal letter to the ‘Vedic Extensions’ block (see L2/17-117).
- Revision of Indic position category for vowel signs.

The encoding model and character repertoire proposed in the present document are suitable for the general representation of Nandinagari in plain text. Characters such as *pr̥ṣṭhamātrā* and Vedic intonation marks are being analyzed and proposals for encoding them are forthcoming.

2 Description

Nandinagari is a Brahmi-based script that was used in southern India between the 11th and 19th centuries CE for producing manuscripts and inscriptions in Sanskrit in south Maharashtra, Karnataka and Andhra Pradesh. It was the official script of the Vijayanagara kingdom of southern India (1336–1646). There are numerous manuscripts and inscriptions bearing Nandinagari. Several of these manuscripts are biscriptal with text in the Kannada and Tigalari (Tulu) scripts. Nandinagari was also used for writing Kannada in Karnataka.

Nandinagari derives from the central group of ‘Nagari’ scripts and is related to Devanagari. There are several similarities between Nandinagari and Devanagari in terms of character repertoire, glyphic representation, and structure (see comparisons in tables 1–4). However, Nandinagari differs from Devanagari in terms of letterforms, the lack of a connecting headline, and in the rendering of consonant-vowel combinations and consonant conjuncts. There are several styles of Nandinagari, which are properly defined as variants of this particular type of ‘Nagari’ and do not resemble styles of other members of this class. As such, Nandinagari cannot be considered a stylistic variant of Devanagari. The independent status of Nandinagari is articulated by Saraju Rath (2009), who writes:

From statements in various early and recent secondary literature [...] one could infer that Nandināgarī, Nāgarī and Devanāgarī are very close and show only minor distinctions. From a study of the available evidence in manuscripts, however, it is clear that the scripts are indeed related as sister scripts, but that there are significant and systematic differences which justify us in considering them as different scripts. In the case of Nandināgarī the separate status is very clear but because of neglect and misleading statements in secondary literature it is frequently noted that scholars who try to read the script without proper preparation fail and have to give up.

Following the above, despite its similarities to Devanagari, Nandinagari cannot be unified with the ‘Devanagari’ encoding in Unicode. The proper representation of Nandinagari in plain text requires the preservation of the glyphic distinctions of its letterforms, consonant conjuncts, and consonant-vowel ligatures. The script also has its own historical styles and variant forms of letters, which diverge from Devanagari styles. Support for Nandinagari at the character level will provide for representation of the script in plain text. The block will, in turn, offer a means for unifying various styles of the script.

There is an active community of scholars conducting research on Nandinagari in the areas of epigraphy, preservation of manuscripts, and optical-character recognition. The Sri Vadiraja Research Foundation, sponsored jointly by the National Mission for Manuscripts of the Government of India and the Puttige Math in Udupi, Karnataka has been working to preserve Nandinagari palm leaf manuscripts from 2007 to the present (Prabhu 2012). The French Institute of Pondicherry has also digitized its collection of Nandinagari manuscripts and made them available online (see <http://apps.ifpindia.org/manuscripts/>). Study of Nandinagari is also advanced through the work of independent specialists, who have analyzed manuscripts and produced character inventories (see figures 19–28). Moreover, there have been recent attempts to develop technologies for optical-character recognition of Nandinagari (Guruprasad *et al* 2011, 2013). An encoding for Nandinagari in the Unicode will help to advance research, study, and preservation of the script.

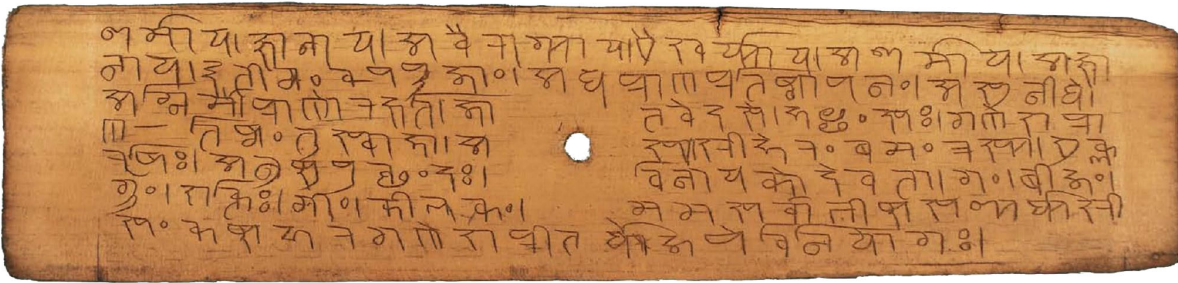
3 Script Details

3.1 Structure

The general structure of Nandinagari is similar to that of Devanagari.

3.2 Headstroke

Headstrokes are an inherent feature of Nandinagari letters, but their behavior differs from headstrokes in modern Devanagari.



Lines 1 and 2 of the above folio read as follows:

ॐ मी या क्क ना या श वै ना ग्गा या ऐ र्व र्ग्या या श ॐ मी या श क्क
ना या ? ती ? प पु क्का श घ प्रा ण प्र ति ष्ठा प न ॐ श यु नी धी

dha-rmā-ya . jñā-nā-ya . a-vai-rā-gyā-ya . ai-śva-ryyā-ya . a-dha-rmā-ya . a-jñā-[-]
nā-ya . ? nī . ? pa-pū-jām . a-tha-prā-ṇa-pra-ti-ṣṭhā-pa-nam . a-su-nī-the .

As a general convention, headstroke connections in Nandinagari are restricted to an *akṣara* (orthographic syllable) and do not extend to neighboring syllables. The headstroke connects vowel / consonant letters and spacing dependent vowels of an *akṣara*, while individual *akṣara*-s are separated by spaces.

3.3 Character repertoire

The proposed repertoire is based upon character inventories in manuscripts (see figures 1 and 2) and those published in secondary sources, such as Grünendahl (2001) and Visalakshy (2003). The representative glyphs are normalizations of forms attested in these sources. Several characters have variant forms, which are to be treated as glyphic variants. The glyphs used here have been designed by the proposal author.

4 Proposed Repertoire

4.1 Vowel letters

There are 12 vowel letters:

- ॐ NANDINAGARI VOWEL LETTER A
- ॐ NANDINAGARI VOWEL LETTER AA
- ॐ NANDINAGARI VOWEL LETTER I
- ॐ NANDINAGARI VOWEL LETTER II

३	NANDINAGARI VOWEL LETTER U
ॣ	NANDINAGARI VOWEL LETTER UU
॥	NANDINAGARI VOWEL LETTER VOCALIC R
॥	NANDINAGARI VOWEL LETTER VOCALIC RR
॥	NANDINAGARI VOWEL LETTER E
॥	NANDINAGARI VOWEL LETTER AI
॥	NANDINAGARI VOWEL LETTER O
॥	NANDINAGARI VOWEL LETTER AU

Distinctive letters for *VOWEL LETTER VOCALIC L and *VOWEL LETTER VOCALIC LL are not attested, but space for them has been reserved in the event that attestations are discovered. See section 5.1 for details.

4.2 Vowel signs

There are 11 dependent vowel signs:

०	NANDINAGARI VOWEL SIGN AA
०	NANDINAGARI VOWEL SIGN I
०	NANDINAGARI VOWEL SIGN II
०	NANDINAGARI VOWEL SIGN U
०	NANDINAGARI VOWEL SIGN UU
०	NANDINAGARI VOWEL SIGN VOCALIC R
०	NANDINAGARI VOWEL SIGN VOCALIC RR
०	NANDINAGARI VOWEL SIGN E
०	NANDINAGARI VOWEL SIGN AI
०	NANDINAGARI VOWEL SIGN O
०	NANDINAGARI VOWEL SIGN AU

The ० VOWEL SIGN I is positioned at the top-left edge of letters that have headstrokes. For other letters it hangs above the top-left portion of the body. The style of writing the sign varies considerably, and in rapid writing the stroke may be positioned to the left of the base and may appear as an elongated curve.

Distinctive forms for *VOWEL SIGN VOCALIC L and *VOWEL SIGN VOCALIC LL are not attested. Space has been reserved for them.

4.3 Consonant letters

There are 35 consonant letters:

क	NANDINAGARI LETTER KA	ॡ	NANDINAGARI LETTER DHA
ख	NANDINAGARI LETTER KHA	ढ	NANDINAGARI LETTER NA
ग	NANDINAGARI LETTER GA	प	NANDINAGARI LETTER PA
घ	NANDINAGARI LETTER GHA	फ	NANDINAGARI LETTER PHA
ङ	NANDINAGARI LETTER NGA	ब	NANDINAGARI LETTER BA
च	NANDINAGARI LETTER CA	भ	NANDINAGARI LETTER BHA
छ	NANDINAGARI LETTER CHA	म	NANDINAGARI LETTER MA
ज	NANDINAGARI LETTER JA	य	NANDINAGARI LETTER YA
झ	NANDINAGARI LETTER JHA	र	NANDINAGARI LETTER RA
ञ	NANDINAGARI LETTER NYA	ल	NANDINAGARI LETTER LA
ट	NANDINAGARI LETTER TTA	व	NANDINAGARI LETTER VA
ठ	NANDINAGARI LETTER TTHA	श	NANDINAGARI LETTER SHA
ड	NANDINAGARI LETTER DDA	ष	NANDINAGARI LETTER SSA
ढ	NANDINAGARI LETTER DDHA	स	NANDINAGARI LETTER SA
ण	NANDINAGARI LETTER NNA	ह	NANDINAGARI LETTER HA
त	NANDINAGARI LETTER TA	ळ	NANDINAGARI LETTER LLA
थ	NANDINAGARI LETTER THA	ॠ	NANDINAGARI LETTER RRA
द	NANDINAGARI LETTER DA		

The ॠ NANDINAGARI LETTER RRA is not part of the traditional repertoire. It appears to have been introduced in the 11th century for transcribing the Kannada letter ಱ U+0CB1 KANNADA LETTER RRA (see figure 3).

4.4 Virama

◌ NANDINAGARI SIGN VIRAMA

The ◌ VIRAMA has two functions, similar to the corresponding character of Devanagari. It is used as a *halanta* for marking the absence of the inherent vowel of a consonant letter. It is also a control character that is used for producing conjuncts.

4.5 Vowel modifiers

◌◌ NANDINAGARI SIGN ANUSVARA

◌ꣳ NANDINAGARI SIGN VISARGA

The ◌◌ ANUSVARA is used for indicating nasalization. It is placed to the right of a base letter or right-side vowel sign. The ◌ꣳ VISARGA is used for representing post-vocalic aspiration in words of Sanskrit origin.

4.6 Avagraha

ꣳ NANDINAGARI SIGN AVAGRAHA

This sign is used for marking the elision of word-initial *a* in Sanskrit as a result of sandhi (see figure 5).

4.7 Auspicious sign

ꣳ NANDINAGARI SIGN SIDDHAM

The sign ꣳ SIDDHAM is used as an invocation at the beginning of documents (see figure 3).

4.8 Punctuation

— NANDINAGARI HEADSTROKE

The — HEADSTROKE is used as a sign of spacing or joining a word. It may be used for connecting a word that is broken on account of imperfections on a writing surface. It is also used as gap filler (see figure 6).

Nandinagari uses | *daṇḍā* and || double *daṇḍā* for punctuation. These should be unified with the corresponding Devanagari characters. Script extensions have been specified in section 6.5.

4.9 Digits

A full set of digits is used in Nandinagari: ० १, २, ३, ४, ५, ६, ७, ८, ९. These are derived from digits of the Kannada script (see table 4). Slight differences in shape between digits in Nandinagari sources and Kannada forms should be considered glyphic variants. Kannada digits should be extended for usage in Nandinagari. Script extensions have been specified in section 6.5.

4.10 Characters not proposed at present

The following characters are attested in Nandinagari sources, but are not included in the proposed repertoire because additional information is needed.

Gap filler The sign ॥ is used for marking gaps and spaces in manuscripts (see figure 14). It may be interpreted as a ligated ॥ double *daṇḍā*, but its shape and contexts of use suggest that it is a separate character.

Vedic intonation signs The following signs are used in Vedic manuscripts: ◌̣ *udatta* (?), ◌̤ *anudatta* (?), ◌̥ *svarita* (?). Usage of these signs is shown in figures 12 and 13. They are not proposed for encoding at present because the identities of the signs remain to be established.

Vedic nasalization signs The signs ◌̣̣ and ◌̣̣̣ are used for representing nasalization in Vedic texts. They are letter-like characters and behave similar to ◌̣ U+1135E GRANTHA LETTER VEDIC ANUSVARA, and ◌̣̣ U+1135F GRANTHA LETTER VEDIC DOUBLE ANUSVARA. Another nasal sign ◌̣̣̣ was included in earlier proposals, but it has been removed from the Nandinagari repertoire and has been proposed for inclusion in the ‘Vedic Extensions’ block as *VEDIC SIGN DOUBLE ANUSVARA ANTARGOMUKHA.

ardhavisarga The sign ॠ *ardhavisarga* is used in Vedic texts for indicating *jihvāmūlīya* and *upadhmānīya* (see figures 8, 9). It may be analyzed as either a letter-like character or as a combining mark. The sign may correspond to ◌̣̣ U+1CF2 VEDIC SIGN ARDHAVISARGA of the ‘Vedic Extensions’ block, and may be a candidate for unification.

pr̥ṣṭhamātrā The ◌̣̣̣ VOWEL SIGN AI, ◌̣̣̣ VOWEL SIGN O, and ◌̣̣̣ VOWEL SIGN AU may be represented alternately as the two-part forms ॠ̣̣̣, ॠ̣̣̣, and ॠ̣̣̣, respectively (see figure 15). These forms are constructed using a sign ॠ̣̣̣ called *pr̥ṣṭhamātrā*, which precedes the base letter, followed by ◌̣̣̣ VOWEL SIGN E, ◌̣̣̣ VOWEL SIGN AA or ◌̣̣̣ VOWEL SIGN O, respectively. The prefix vowel sign corresponds to ॠ̣̣̣ U+094E DEVANAGARI VOWEL SIGN PRISHTHAMATRA E. The sign is a strong candidate for encoding, but more evidence is needed in order to fully understand its usage in Nandinagari.

5 Encoded Representations

5.1 Vowel letters

Some independent vowel may be represented using a combination of a vowel letter and a dependent vowel sign. This is not recommended. The encoded character for the independent vowel should be used.

Recommended	Not recommended
ॠ̣̣̣ LETTER AA	ॠ̣̣̣ LETTER A + ◌̣̣̣ VOWEL SIGN AA
ॠ̣̣̣ LETTER II	ॠ̣̣̣ LETTER I + ◌̣̣̣ VOWEL SIGN II
ॠ̣̣̣ LETTER UU	ॠ̣̣̣ LETTER U + ◌̣̣̣ VOWEL SIGN U
ॠ̣̣̣ LETTER AI	ॠ̣̣̣ LETTER E + ◌̣̣̣ VOWEL SIGN E
ॠ̣̣̣ LETTER AU	ॠ̣̣̣ LETTER A + ◌̣̣̣ VOWEL SIGN AU

The ॠ̣̣̣ VOWEL LETTER VOCALIC R and ॠ̣̣̣ VOWEL LETTER VOCALIC RR are also represented as a consonant-vowel combination with the letter ॠ̣̣̣ RA, as:

𑂣 <𑂣 RA, 𑂣 VOWEL SIGN VOCALIC R>

𑂤 <𑂣 RA, 𑂣 VOWEL SIGN VOCALIC RR>

Different representations for independent *ḷ* are shown in manuscripts (figure 1) and script charts (figure 29). These are consonant-vowel combinations with the letter *𑂣* LA:

𑂥 <𑂣 LA, 𑂣 VOWEL SIGN VOCALIC R>

𑂦 <𑂣 LA, 𑂣 VOWEL SIGN U>

5.2 Consonant-vowel combinations

Combinations of consonant and vowel signs and modifiers are represented in encoded text as follows:

cā 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN AA>

ci 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN I>

cī 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN II>

cu 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN U>

cū 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN UU>

cṛ 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN VOCALIC R>

cṝ 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN VOCALIC RR>

ce 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN E>

cai 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN AI>

co 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN O>

cau 𑂣𑂣 <𑂣 CA, 𑂣 VOWEL SIGN AU>

caṃ 𑂣𑂣 <𑂣 CA, 𑂣 ANUSVARA>

caḥ 𑂣𑂣 <𑂣 CA, 𑂣 VISARGA>

Dependent *ḷ* may be represented using the syllable *klī* (see figure 36). This practice occurs in Grantha and other southern Brahmi scripts.

klī 𑂣𑂣 <𑂣 KA, 𑂣 VIRAMA, 𑂣 LA, 𑂣 VOWEL SIGN II>

Some consonant-vowel combinations may be rendered as ligatures:

ku कु <क KA, उ VOWEL SIGN U>
 kū कु <क KA, उ VOWEL SIGN UU>
 kṛ कृ <क KA, ृ VOWEL SIGN VOCALIC R>
 du दु <द DA, उ VOWEL SIGN U>

5.3 Positioning of VIRAMA

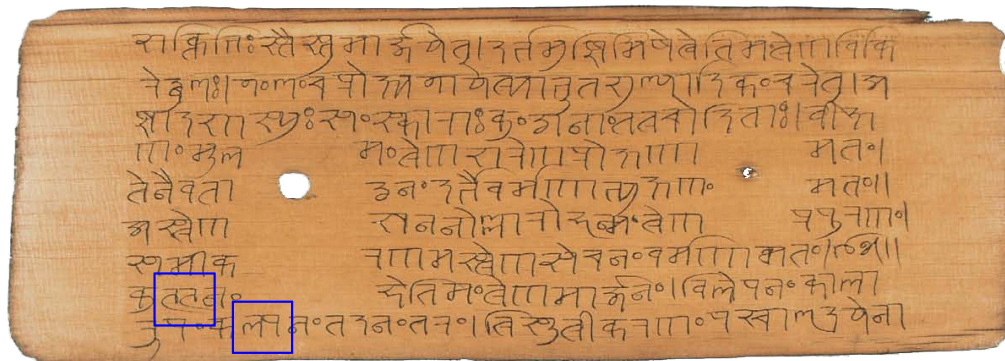
The VIRAMA ligates with the base letter at the lower right edge. It is centered below letters with round bodies.

k क् <क KA, ् VIRAMA>
 c च् <च CA, ् VIRAMA>
 ṭ ट् <ट TTA, ् VIRAMA>

5.4 Consonant Conjuncts

Nandinagari consonant clusters are represented as conjuncts, which are rendered in various ways. Atomic ligatures are standard for some clusters; fusion of letters into distinctive or vertical ligatures is also common. Some letters exhibit special behavior, as in Devanagari. The letter र RA is rendered as *repha* when C₁ and as *ra-kāra* when C₂. The letter य YA takes a post-base form when C₂, similar to Bengali. Half-forms of C₁ are used when the letterform allows for truncation of descenders.

Another common method of representing conjuncts in Nandinagari is to join the consonants of a cluster using an extension of their headstrokes, or by causing each letter in the cluster to touch the right edge of the previous letter. In both cases, the constituent letters retain their nominal shapes. These ‘touching’ conjuncts are meaningful because as a general convention, headstroke connections in Nandinagari are restricted to an *akṣara* (orthographic syllable) and do not extend to neighboring syllables (see section 3.2). Following the conventions of the script, a group of letters connected by a single headstroke, or a group of letters with touching bodies is an indication of membership in an *akṣara*.



The above folio contains two touching conjuncts, shown in blue. The ट् *ṭa* occurs in कुट्टनं *kuttanam* and the ल्प *lpa* occurs in कल्पनं *kalpanam*.

Most conjuncts can be rendered as either a ligature or as a ‘touching’ form. For instance, the cluster $\text{३ da} + \text{३ da}$ may be written as both ३ and ३३ dda . Both forms may be used interchangeably. For this reason, the ‘touching’ conjuncts are to be considered a stylistic variant. They may be selected through the usage of a font. There is no requirement at present to maintain a distinction between ‘touching’ and non-‘touching’ conjuncts in plain text.

The conjunct model for Nandinagari follows that of Devanagari. Conjuncts are to be produced by placing VIRAMA after each letter in a cluster:

$$C, (\text{◌ VIRAMA}, C)^*$$

5.4.1 Examples of common conjuncts

Some ligatures are atomic or *akhaṇḍa* in which the constituent letters may not be recognizable. These are always rendered using the forms below:

kṣa ३ <क KA, ◌ VIRAMA, ष SSA>

jña ३ <ज्ञ JA, ◌ VIRAMA, ञ NYA>

Examples of other distinctive ligatures are:

ccha ३ <च CA, ◌ VIRAMA, च CHA>

dda ३ <द DA, ◌ VIRAMA, द DA>

dma ३ <द DA, ◌ VIRAMA, म MA>

ṣṭa ३ <ष SSA, ◌ VIRAMA, ष TTA>

Ligatures are also produced by joining glyphs vertically:

kka ३ <क KA, ◌ VIRAMA, क KA>

kla ३ <क KA, ◌ VIRAMA, ल LA>

kṣṇa ३ <क KA, ◌ VIRAMA, ष SSA, ◌ VIRAMA, ण NNA>

gla ३ <ग GA, ◌ VIRAMA, ल LA>

ṅga ३ <ङ NGA, ◌ VIRAMA, ग GA>

jjha ३ <ज्ञ JA, ◌ VIRAMA, ज JHA>

ṭva ३ <ट TTA, ◌ VIRAMA, व VA>

dga ३ <द DA, ◌ VIRAMA, ग GA>

ddha ३ <द DA, ◌ VIRAMA, ध DHA>

<i>lla</i>	ल्ल	<ल LA, ॠ VIRAMA, ल LA>
<i>ṣṇa</i>	ऌ	<ष SSA, ॠ VIRAMA, ऌ NNA>
<i>ṣṇva</i>	ऍ	<ष SSA, ॠ VIRAMA, ऌ NNA, ॠ VIRAMA, व VA>
<i>hna</i>	ऩ	<ह HA, ॠ VIRAMA, न NA>
<i>hla</i>	ऱ	<ह HA, ॠ VIRAMA, ल LA>

The letter TA takes different shapes in conjuncts. When it is conjunct initial its left stroke is truncated: त → ढ. When it is conjunct final TA is represented as a semi-circle.

<i>tka</i>	कै	<त TA, ॠ VIRAMA, क KA>
<i>tna</i>	नै	<त TA, ॠ VIRAMA, न NA>
<i>tta</i>	तै	<त TA, ॠ VIRAMA, त TA>
<i>nta</i>	नै	<न NA, ॠ VIRAMA, त TA>
<i>pta</i>	पै	<प PA, ॠ VIRAMA, त TA>
<i>sta</i>	सै	<स SA, ॠ VIRAMA, त TA>

A ligature may be formed using a half-form of C₁ if the letterform provides an opportunity for modification, ie. a half-form can be produced by removing the right descender. This type of conjunct occurs commonly with the following letters: ग → ञ *ga*, त → ढ *ta*, म → ञ *ma*, री → र *śa*, सी → र *sa*.

<i>gga</i>	गग	<ग GA, ॠ VIRAMA, ग GA>
<i>gda</i>	गद	<ग GA, ॠ VIRAMA, द DA>
<i>mpa</i>	मप	<म MA, ॠ VIRAMA, प PA>
<i>śca</i>	रर	<री SHA, ॠ VIRAMA, र CA>
<i>ska</i>	रक	<सी SA, ॠ VIRAMA, क KA>
<i>spa</i>	रप	<सी TA, ॠ VIRAMA, प PA>

5.4.2 Special case: YA

When य YA is final in a cluster it is represented by default using the post-base form ॠ:

<i>kya</i>	कै	<क KA, ॠ VIRAMA, य YA>
<i>kṣya</i>	कै	<क KA, ॠ VIRAMA, ष SSA, ॠ VIRAMA, य YA>
<i>gya</i>	गै	<ग GA, ॠ VIRAMA, य YA>

tmya त्मल <त TA, ॠ VIRAMA, म MA, ॠ VIRAMA, य YA>
tya तल <त TA, ॠ VIRAMA, य YA>
dmya द्मल <द DA, ॠ VIRAMA, म MA, ॠ VIRAMA, य YA>
yya यल <य YA, ॠ VIRAMA, य YA>
ṣya षल <ष SSA, ॠ VIRAMA, य YA>

The post-base YA can connect to the preceding letter at different positions:

ṭya ढल <ढ TTA, ॠ VIRAMA, य YA>

5.4.3 Special case: RA

The letter र RA is rendered by default as ्र *repha* when C₁:

rka र्क <र RA, ॠ VIRAMA, क KA>
rra र्र <र RA, ॠ VIRAMA, र RA>
rṣa र्ष <र RA, ॠ VIRAMA, ष SSA>

Non-initial RA has the default form ्र *ra-kāra*. The *ra-kāra* attaches to the right descender. It attaches to a stem with letters that do not have a descender.

ṭra ढ्र <ढ TTA, ॠ VIRAMA, र RA>
tra त्र <त TA, ॠ VIRAMA, र RA>
pra प्र <प PA, ॠ VIRAMA, र RA>
śra श्र <श SHA, ॠ VIRAMA, र RA>
sra स्र <स SA, ॠ VIRAMA, र RA>

5.4.4 Special case: YA + RA

Given the above rules for RA and YA, the following are the normal interactions for the letters when they are adjacent in a cluster.

rya र्य <र RA, ॠ VIRAMA, य YA>
rṣya र्षर् <र RA, ॠ VIRAMA, ष SSA, ॠ VIRAMA, य YA>
prya प्र्य <प PA, ॠ VIRAMA, र RA, ॠ VIRAMA, य YA>

5.4.5 ‘Touching’ conjuncts

‘Touching’ conjuncts are produced by joining the headstrokes of letters or by causing the letters of a cluster to touch at adjacent edges. In both cases, letters appear without modification (see section 5.4.5). Apart from the *akhaṇḍa* conjuncts *kṣa* and *jña*, any cluster can be rendered as a ‘touching’ conjunct.

Examples of such conjuncts produced by connecting headstrokes:

tpa तप <त TA, ् VIRAMA, प PA>

dda दद <द DA, ् VIRAMA, द DA>

bda बद <ब BA, ् VIRAMA, द DA>

Examples producing by joining letters at edges:

ḍḍa ढढ <ढ DDA, ् VIRAMA, ढ DDA>

dda दद <द DA, ् VIRAMA, द DA>

tpa तप <त TA, ् VIRAMA, प PA>

bda बद <ब BA, ् VIRAMA, द DA>

stha स्तथ <स SA, ् VIRAMA, थ THA>

‘Touching’ conjuncts may contain *akhaṇḍa* ligatures. In such cases, the atomic ligature is produced first then fused with the adjacent letter:

kṣma क्क्षम <क KA, ् VIRAMA, क्ष SSA, ् VIRAMA, म MA>

The headstroke is elongated for letters without a full-width headstroke so that the connection extends fully above all letters. This pertains particularly to क KA, whose normative glyph has a half-width headstroke.

kśa क्क्ष <क KA, ् VIRAMA, क्ष SHA>

5.4.6 Modifying conjunct behavior

Default conjunct formation may be modified using ZWJ U+200C ZERO WIDTH NON-JOINER:

$C_1, \text{VIRAMA}, \text{ZWJ}, C_2$

This produces a visible VIRAMA under consonants:

kṣa क्क्ष <क KA, ् VIRAMA, क्ष SSA>

kṣa क्क्ष <क KA, ् VIRAMA, ZWJ ZWNJ, क्ष SSA>

5.4.7 Glyph requirements for conjuncts

In the event that a font lacks ligatures for certain conjuncts, the fallback should be to display a visible ◌ VIRAMA beneath each bare consonant in the cluster.

Another fallback for missing conjuncts glyphs is to produce ‘touching’ conjuncts. This removes the need to use visible VIRAMA and offers a more natural alternative that aligns with the orthography for conjuncts in the script.

5.5 Invocation signs

In addition to ? NANDINGARI SIGN SIDDHAM, the syllable ॐ om̐ is used frequently. The om̐ is not encoded as a distinctive character for Nandinagari. It is to be represented using the sequence:

om̐ ॐ ◌ <ॐ O, ◌ ANUSVARA>

5.6 Punctuation

A sequence of multiple headstrokes are generally unconnected.

𑂀𑂁𑂂 <𑂀 BHA, 𑂁 HEADSTROKE, 𑂂 HEADSTROKE, 𑂃 JHA>

The HEADSTROKE may also occur between *daṇḍā*-s at the end of a section:

𑂀𑂁𑂂 <𑂀 U+0965 DEVANAGARI DOUBLE DANDA, 𑂁 HEADSTROKE, 𑂂 HEADSTROKE, 𑂃 U+0965 DEVANAGARI DOUBLE DANDA>

5.7 Number forms

Fraction signs occur in Nandinagari sources (see figure 7; also L2/15-243: 22). These may be represented using characters already encoded in the ‘Common Indic Number Forms’ block (U+A830):

¼	𑂀	U+A830 NORTH INDIC FRACTION ONE QUARTER
½	𑂁	U+A831 NORTH INDIC FRACTION ONE HALF
¾	𑂂	U+A832 NORTH INDIC FRACTION THREE QUARTERS
⅙	𑂃	U+A833 NORTH INDIC FRACTION ONE SIXTEENTH
⅛	𑂄	U+A834 NORTH INDIC FRACTION ONE EIGHTH
⅜	𑂅	U+A835 NORTH INDIC FRACTION THREE SIXTEENTHS

These characters are specified as script extensions for Nandinagari. The ‘Common Indic Number Forms’ are described briefly in *The Unicode Standard* (chapter 22.3 ‘Numerals’, pp. 770–771) and in more detail in the original encoding proposal (L2/07-354).

5.8 Collation

The sort order for Nandinagari is as follows:

अ A < आ AA < इ I < ई II < उ U < ऊ UU < ए VOCALIC R < ऐ VOCALIC RR <
 ँ E < ऐ AI < ओ O < औ AU < क KA < ख KHA < ग GA < घ GHA < ङ NGA <
 च CA < छ CHA < ज JA < ङ NYA < ट TTA < ठ TTHA < ड DDA < ढ DDHA <
 ण NNA < त TA < थ THA < द DA < ध DHA < न NA < प PA < फ PHA < ब BA <
 भ BHA < म MA < य YA < र RA < ल LA < व VA < श SHA < ष SSA < स SA <
 ह HA < ल LLA < र RRA < ि VOWEL SIGN I < ी VOWEL SIGN II < ु VOWEL SIGN U <
 ू VOWEL SIGN UU < ्र VOWEL SIGN VOCALIC R < ्र् VOWEL SIGN VOCALIC RR <
 े VOWEL SIGN E < ै VOWEL SIGN AI < ो VOWEL SIGN O < ौ VOWEL SIGN AU <
 ् VIRAMA

The letter र RRA does not have a position in the traditional order. It is to be sorted after ल LLA. The following characters have secondary weights:

◌ं ANUSVARA, ◌ः VISARGA

6 Character Data

6.1 Character Properties

In the format of `UnicodeData.txt`:

```
11B90;NANDINAGARI LETTER A;Lo;0;L;;;;;N;;;;;
11B91;NANDINAGARI LETTER AA;Lo;0;L;;;;;N;;;;;
11B92;NANDINAGARI LETTER I;Lo;0;L;;;;;N;;;;;
11B93;NANDINAGARI LETTER II;Lo;0;L;;;;;N;;;;;
11B94;NANDINAGARI LETTER U;Lo;0;L;;;;;N;;;;;
11B95;NANDINAGARI LETTER UU;Lo;0;L;;;;;N;;;;;
11B96;NANDINAGARI LETTER VOCALIC R;Lo;0;L;;;;;N;;;;;
11B97;NANDINAGARI LETTER VOCALIC RR;Lo;0;L;;;;;N;;;;;
11B98;<reserved>
11B99;<reserved>
11B9A;NANDINAGARI LETTER E;Lo;0;L;;;;;N;;;;;
11B9B;NANDINAGARI LETTER AI;Lo;0;L;;;;;N;;;;;
```



```

11B9C;NANDINAGARI LETTER O;Lo;0;L;;;;N;;;;;
11B9D;NANDINAGARI LETTER AU;Lo;0;L;;;;N;;;;;
11B9E;NANDINAGARI LETTER KA;Lo;0;L;;;;N;;;;;
11B9F;NANDINAGARI LETTER KHA;Lo;0;L;;;;N;;;;;
11BA0;NANDINAGARI LETTER GA;Lo;0;L;;;;N;;;;;
11BA1;NANDINAGARI LETTER GHA;Lo;0;L;;;;N;;;;;
11BA2;NANDINAGARI LETTER NGA;Lo;0;L;;;;N;;;;;
11BA3;NANDINAGARI LETTER CA;Lo;0;L;;;;N;;;;;
11BA4;NANDINAGARI LETTER CHA;Lo;0;L;;;;N;;;;;
11BA5;NANDINAGARI LETTER JA;Lo;0;L;;;;N;;;;;
11BA6;NANDINAGARI LETTER JHA;Lo;0;L;;;;N;;;;;
11BA7;NANDINAGARI LETTER NYA;Lo;0;L;;;;N;;;;;
11BA8;NANDINAGARI LETTER TTA;Lo;0;L;;;;N;;;;;
11BA9;NANDINAGARI LETTER TTHA;Lo;0;L;;;;N;;;;;
11BAA;NANDINAGARI LETTER DDA;Lo;0;L;;;;N;;;;;
11BAB;NANDINAGARI LETTER DDHA;Lo;0;L;;;;N;;;;;
11BAC;NANDINAGARI LETTER NNA;Lo;0;L;;;;N;;;;;
11BAD;NANDINAGARI LETTER TA;Lo;0;L;;;;N;;;;;
11BAE;NANDINAGARI LETTER THA;Lo;0;L;;;;N;;;;;
11BAF;NANDINAGARI LETTER DA;Lo;0;L;;;;N;;;;;
11BB0;NANDINAGARI LETTER DHA;Lo;0;L;;;;N;;;;;
11BB1;NANDINAGARI LETTER NA;Lo;0;L;;;;N;;;;;
11BB2;NANDINAGARI LETTER PA;Lo;0;L;;;;N;;;;;
11BB3;NANDINAGARI LETTER PHA;Lo;0;L;;;;N;;;;;
11BB4;NANDINAGARI LETTER BA;Lo;0;L;;;;N;;;;;
11BB5;NANDINAGARI LETTER BHA;Lo;0;L;;;;N;;;;;
11BB6;NANDINAGARI LETTER MA;Lo;0;L;;;;N;;;;;
11BB7;NANDINAGARI LETTER YA;Lo;0;L;;;;N;;;;;
11BB8;NANDINAGARI LETTER RA;Lo;0;L;;;;N;;;;;
11BB9;NANDINAGARI LETTER LA;Lo;0;L;;;;N;;;;;
11BBA;NANDINAGARI LETTER VA;Lo;0;L;;;;N;;;;;
11BBB;NANDINAGARI LETTER SHA;Lo;0;L;;;;N;;;;;
11BBC;NANDINAGARI LETTER SSA;Lo;0;L;;;;N;;;;;
11BBD;NANDINAGARI LETTER SA;Lo;0;L;;;;N;;;;;
11BBE;NANDINAGARI LETTER HA;Lo;0;L;;;;N;;;;;
11BBF;NANDINAGARI LETTER LLA;Lo;0;L;;;;N;;;;;
11BC0;NANDINAGARI LETTER RRA;Lo;0;L;;;;N;;;;;
11BC1;NANDINAGARI VOWEL SIGN AA;Mc;0;L;;;;N;;;;;
11BC2;NANDINAGARI VOWEL SIGN I;Mn;0;NSM;;;;N;;;;;
11BC3;NANDINAGARI VOWEL SIGN II;Mc;0;L;;;;N;;;;;
11BC4;NANDINAGARI VOWEL SIGN U;Mn;0;NSM;;;;N;;;;;
11BC5;NANDINAGARI VOWEL SIGN UU;Mn;0;NSM;;;;N;;;;;
11BC6;NANDINAGARI VOWEL SIGN VOCALIC R;Mn;0;NSM;;;;N;;;;;
11BC7;NANDINAGARI VOWEL SIGN VOCALIC RR;Mn;0;NSM;;;;N;;;;;
11BC8;<reserved>
11BC9;<reserved>
11BCA;NANDINAGARI VOWEL SIGN E;Mn;0;NSM;;;;N;;;;;
11BCB;NANDINAGARI VOWEL SIGN AI;Mn;0;NSM;;;;N;;;;;
11BCC;NANDINAGARI VOWEL SIGN O;Mc;0;L;;;;N;;;;;
11BCD;NANDINAGARI VOWEL SIGN AU;Mc;0;L;;;;N;;;;;
11BCE;NANDINAGARI SIGN ANUSVARA;Mc;0;L;;;;N;;;;;
11BCF;NANDINAGARI SIGN VISARGA;Mc;0;L;;;;N;;;;;
11BD0;NANDINAGARI SIGN VIRAMA;Mc;9;L;;;;N;;;;;
11BD1;NANDINAGARI SIGN AVAGRAHA;Lo;0;L;;;;N;;;;;
11BD2;NANDINAGARI SIGN SIDDHAM;Lo;0;L;;;;N;;;;;
11BD3;NANDINAGARI HEADSTROKE;Lo;0;L;;;;N;;;;;

```

6.2 Linebreaking

In the format of LineBreak.txt:

```
11B90..11B97; AL # NANDINAGARI LETTER A .. NANDINAGARI LETTER VOCALIC RR
11B9A..11BC0; AL # NANDINAGARI LETTER E .. NANDINAGARI LETTER RRA
11BC1..11BC7; CM # NANDINAGARI VOWEL SIGN AA .. NANDINAGARI VOWEL SIGN VOCALIC RR
11BCA..11BD0; CM # NANDINAGARI VOWEL SIGN E .. NANDINAGARI SIGN VIRAMA
11BD1..11BD3; AL # NANDINAGARI SIGN AVAGRAHA .. NANDINAGARI HEADSTROKE
```

6.3 Syllabic Categories

In the format of IndicSyllabicCategory.txt:

```
# Indic_Syllabic_Category=Bindu
11BCE ; Bindu # Mc NANDINAGARI SIGN ANUSVARA

# Indic_Syllabic_Category=Visarga
11BCF ; Visarga # Mc NANDINAGARI SIGN VISARGA

# Indic_Syllabic_Category=Virama
11BD0 ; Virama # Mn NANDINAGARI SIGN VIRAMA

# Indic_Syllabic_Category=Vowel_Independent
11B90..11B97 ; Vowel_Independent # Lo [9] NANDINAGARI LETTER A ..
NANDINAGARI LETTER VOCALIC RR
11B9A..11BC0 ; Vowel_Independent # Lo [4] NANDINAGARI LETTER E ..
NANDINAGARI LETTER AU

# Indic_Syllabic_Category=Vowel_Dependent
11BC1 ; Vowel_Dependent # Mc NANDINAGARI VOWEL SIGN AA
11BC2 ; Vowel_Dependent # Mn NANDINAGARI VOWEL SIGN I
11BC3 ; Vowel_Dependent # Mc NANDINAGARI VOWEL SIGN II
11BC4..11BC7 ; Vowel_Dependent # Mn [4] NANDINAGARI VOWEL SIGN U ..
NANDINAGARI VOWEL SIGN VOCALIC RR
11BCA..11BCB ; Vowel_Dependent # Mn [2] NANDINAGARI VOWEL SIGN E ..
NANDINAGARI VOWEL SIGN AI
11BCC..11BCD ; Vowel_Dependent # Mc [2] NANDINAGARI VOWEL SIGN O ..
NANDINAGARI VOWEL SIGN AU

# Indic_Syllabic_Category=Consonant
11B9E..11BC0 ; Consonant # Lo [35] NANDINAGARI LETTER KA ..
NANDINAGARI LETTER RRA
```

6.4 Positional Categories

In the format of IndicPositionalCategory.txt:

```
# Indic_Positional_Category=Top
11BCA..11BCB ; Top # Mn [2] NANDINAGARI VOWEL SIGN E ..
NANDINAGARI VOWEL SIGN AI

# Indic_Positional_Category=Top_And_Left
11BC2 ; Top_And_Left # Mn NANDINAGARI VOWEL SIGN I
```

```

# Indic_Positional_Category=Bottom
11BC4..11BC7 ; Bottom # Mn [4] NANDINAGARI VOWEL SIGN U ..
                                NANDINAGARI VOWEL SIGN VOCALIC RR
11BD0 ; Bottom # Mn NANDINAGARI SIGN VIRAMA

# Indic_Positional_Category=Right
11BC1 ; Right # Mc NANDINAGARI VOWEL SIGN AA
11BC3 ; Right # Mc NANDINAGARI VOWEL SIGN II
11BCC..11BCD ; Right # Mc [2] NANDINAGARI VOWEL SIGN O ..
                                NANDINAGARI VOWEL SIGN AU
11BCE..11BCF ; Right # Mc [2] NANDINAGARI SIGN ANUSVARA ..
                                NANDINAGARI SIGN VISARGA

```

6.5 Script Extensions

The following characters should be extended for use with Nandinagari in `ScriptExtensions.txt`:

```

0964..0965 ; # Po [2] DEVANAGARI DANDA..DEVANAGARI DOUBLE DANDA
0CE6..0CEF ; # Nd [10] KANNADA DIGIT ZERO..KANNADA DIGIT NINE
1CE9 ; # Lo VEDIC SIGN ANUSVARA ANTARGOMUKHA
A830..A835 ; # No [6] NORTH INDIC FRACTION ONE QUARTER..
                                NORTH INDIC FRACTION THREE SIXTEENTHS

```

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	11B9	11BA	11BB	11BC	11BD	11BE
0	𑌘 11B90	𑌙 11BA0	𑌚 11BB0	𑌛 11BC0	𑌜 11BD0	
1	𑌝 11B91	𑌞 11BA1	𑌟 11BB1	𑌠 11BC1	𑌡 11BD1	
2	𑌢 11B92	𑌣 11BA2	𑌤 11BB2	𑌥 11BC2	𑌦 11BD2	
3	𑌧 11B93	𑌨 11BA3	𑌩 11BB3	𑌪 11BC3	𑌫 11BD3	
4	𑌬 11B94	𑌭 11BA4	𑌮 11BB4	𑌯 11BC4		
5	𑌰 11B95	𑌱 11BA5	𑌲 11BB5	𑌳 11BC5		
6	𑌵 11B96	𑌶 11BA6	𑌷 11BB6	𑌸 11BC6		
7	𑌹 11B97	𑌺 11BA7	𑌻 11BB7	𑌼 11BC7		
8		𑌽 11BA8	𑌾 11BB8			
9		𑌿 11BA9	𑍀 11BB9			
A	𑍃 11B9A	𑍄 11BAA	𑍅 11BBA	𑍆 11BCA		
B	𑍇 11B9B	𑍈 11BAB	𑍉 11BBB	𑍊 11BCB		
C	𑍋 11B9C	𑍌 11BAC	𑍍 11BBC	𑍎 11BCC		
D	𑍏 11B9D	𑍐 11BAD	𑍑 11BBD	𑍒 11BCD		
E	𑍓 11B9E	𑍔 11BAE	𑍕 11BBE	𑍖 11BCE		
F	𑍙 11B9F	𑍚 11BAF	𑍛 11BBF	𑍜 11BCF		

Independent vowels

11B90	अ	NANDINAGARI LETTER A
11B91	आ	NANDINAGARI LETTER AA
11B92	इ	NANDINAGARI LETTER I
11B93	ई	NANDINAGARI LETTER II
11B94	उ	NANDINAGARI LETTER U
11B95	ऊ	NANDINAGARI LETTER UU
11B96	ऋ	NANDINAGARI LETTER VOCALIC R
11B97	ॠ	NANDINAGARI LETTER VOCALIC RR
11B98	◻	<reserved>
11B99	◻	<reserved>
11B9A	ए	NANDINAGARI LETTER E
11B9B	ऐ	NANDINAGARI LETTER AI
11B9C	ऒ	NANDINAGARI LETTER O
11B9D	औ	NANDINAGARI LETTER AU

Consonants

11B9E	क	NANDINAGARI LETTER KA
11B9F	ख	NANDINAGARI LETTER KHA
11BA0	ग	NANDINAGARI LETTER GA
11BA1	घ	NANDINAGARI LETTER GHA
11BA2	ङ	NANDINAGARI LETTER NGA
11BA3	च	NANDINAGARI LETTER CA
11BA4	छ	NANDINAGARI LETTER CHA
11BA5	ज	NANDINAGARI LETTER JA
11BA6	झ	NANDINAGARI LETTER JHA
11BA7	ञ	NANDINAGARI LETTER NYA
11BA8	ट	NANDINAGARI LETTER TTA
11BA9	ठ	NANDINAGARI LETTER TTHA
11BAA	ड	NANDINAGARI LETTER DDA
11BAB	ड्ह	NANDINAGARI LETTER DDHA
11BAC	ण	NANDINAGARI LETTER NNA
11BAD	त	NANDINAGARI LETTER TA
11BAE	थ	NANDINAGARI LETTER THA
11BAF	द	NANDINAGARI LETTER DA
11BB0	ध	NANDINAGARI LETTER DHA
11BB1	न	NANDINAGARI LETTER NA
11BB2	प	NANDINAGARI LETTER PA
11BB3	फ	NANDINAGARI LETTER PHA
11BB4	ब	NANDINAGARI LETTER BA
11BB5	भ	NANDINAGARI LETTER BHA
11BB6	म	NANDINAGARI LETTER MA
11BB7	य	NANDINAGARI LETTER YA
11BB8	र	NANDINAGARI LETTER RA
11BB9	ल	NANDINAGARI LETTER LA
11BBA	व	NANDINAGARI LETTER VA
11BBB	श	NANDINAGARI LETTER SHA
11BBC	ष	NANDINAGARI LETTER SSA
11BBD	स	NANDINAGARI LETTER SA
11BBE	ह	NANDINAGARI LETTER HA
11BBF	ळ	NANDINAGARI LETTER LLA
11BC0	ॠ	NANDINAGARI LETTER RRA

Dependent vowel signs

11BC1	◌ा	NANDINAGARI VOWEL SIGN AA
11BC2	◌ि	NANDINAGARI VOWEL SIGN I
11BC3	◌ी	NANDINAGARI VOWEL SIGN II
11BC4	◌ु	NANDINAGARI VOWEL SIGN U
11BC5	◌ू	NANDINAGARI VOWEL SIGN UU
11BC6	◌ृ	NANDINAGARI VOWEL SIGN VOCALIC R
11BC7	◌ॠ	NANDINAGARI VOWEL SIGN VOCALIC RR
11BC8	◻	<reserved>
11BC9	◻	<reserved>
11BCA	◌े	NANDINAGARI VOWEL SIGN E
11BCB	◌ै	NANDINAGARI VOWEL SIGN AI
11BCC	◌ो	NANDINAGARI VOWEL SIGN O
11BCD	◌ौ	NANDINAGARI VOWEL SIGN AU

Various signs

11BCE	◌◌	NANDINAGARI SIGN ANUSVARA
11BCF	◌ः	NANDINAGARI SIGN VISARGA
11BD0	◌्	NANDINAGARI SIGN VIRAMA

Additional sign

11BD1	◌ऽ	NANDINAGARI SIGN AVAGRAHA
-------	----	---------------------------

Auspicious sign

11BD2	◌ॐ	NANDINAGARI SIGN SIDDHAM
-------	----	--------------------------

Punctuation

11BD3	◌-	NANDINAGARI HEADSTROKE
		• used as a spacing or filler mark

Nandinagari Devanagari			Nandinagari Devanagari		
KA	क	क	DHA	ध	ध
KHA	ख	ख	NA	न	न
GA	ग	ग	PA	प	प
GHA	घ	घ	PHA	फ	फ
NGA	ङ	ङ	BA	ब	ब
CA	च	च	BHA	भ	भ
CHA	छ	छ	MA	म	म
JA	ज	ज	YA	य	य
JHA	झ	झ	RA	र	र
NYA	ञ	ञ	LA	ल	ल
TTA	ट	ट	VA	व	व
TTHA	ठ	ठ	SHA	श	श
DDA	ड	ड	SSA	ष	ष
DDHA	ढ	ढ	SA	स	स
NNA	ण	ण	HA	ह	ह
TA	त	त	LLA	ळ	ळ
THA	थ	थ	RRA	र	र
DA	द	द			

Table 1: Comparison of basic letters and signs of Nandinagari and Devanagari.

	Nandinagari	Devanagari		Nandinagari	Devanagari
A	अ	अ		Inherent vowel	
AA	आ	आ	SIGN AA	ा	ा
I	इ	इ	SIGN I	ि	ि
II	ई	ई	SIGN II	ी	ी
U	उ	उ	SIGN U	ु	ु
UU	ऊ	ऊ	SIGN UU	ू	ू
VOCALIC R	ऋ	ऋ	SIGN VOCALIC R	्र	्र
VOCALIC RR	ॠ	ॠ	SIGN VOCALIC RR	्र	्र
E	ए	ए	SIGN E	े	े
AI	ऐ	ऐ	SIGN AI	ै	ै
O	ओ	ओ	SIGN O	ो	ो
AU	औ	औ	SIGN AU	ौ	ौ

Table 2: Comparison of basic letters and signs of Nandinagari and Devanagari.

	Nandinagari	Devanagari
ANUSVARA	◌ं	◌ं
VISARGA	◌ः	◌ः
VIRAMA	◌्	◌्
AVAGRAHA	◌ः	◌ः

Table 3: Comparison of various signs of Nandinagari and Devanagari.

	Nandinagari	Kannada	Devanagari
0	०	೦	०
1	१	೧	१
2	२	೨	२
3	३	೩	३
4	४	೪	४
5	५	೫	५
6	६	೬	६
7	७	೭	७
8	८	೮	८
9	९	೯	९

Table 4: Comparison of digits of Nandinagari, Kannada, and Devanagari.

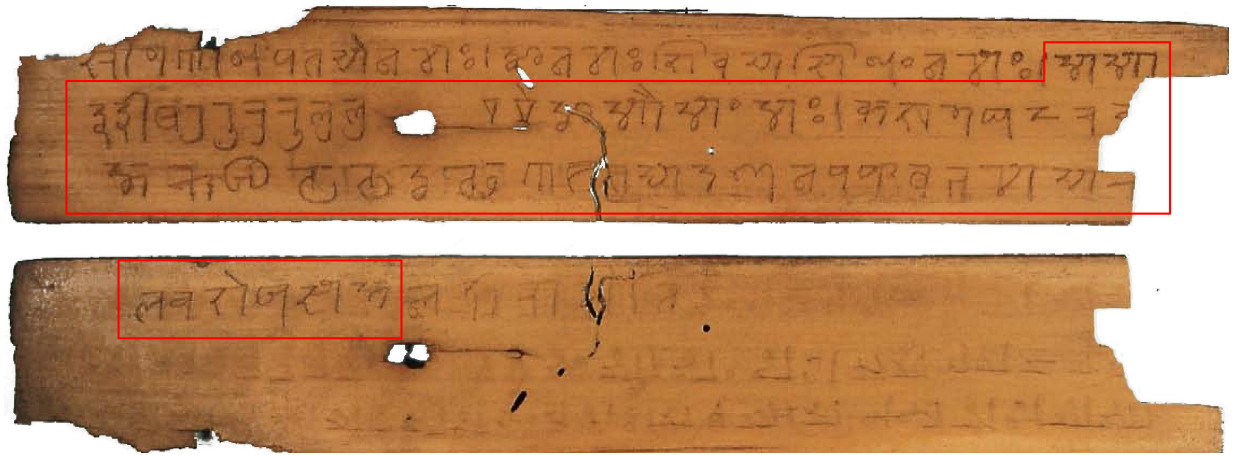


Figure 1: Nandinagari character inventory in a manuscript. Note the representation of the vocalic letters r , \bar{r} , \bar{l} , \bar{l} using ॠ RA and ॡ LA combined with ॢ VOWEL SIGN U. The letter ॣ NGA is shown without the \circ bindu. The letter । CHA and half of ॠ RA is missing because the folio is damaged.

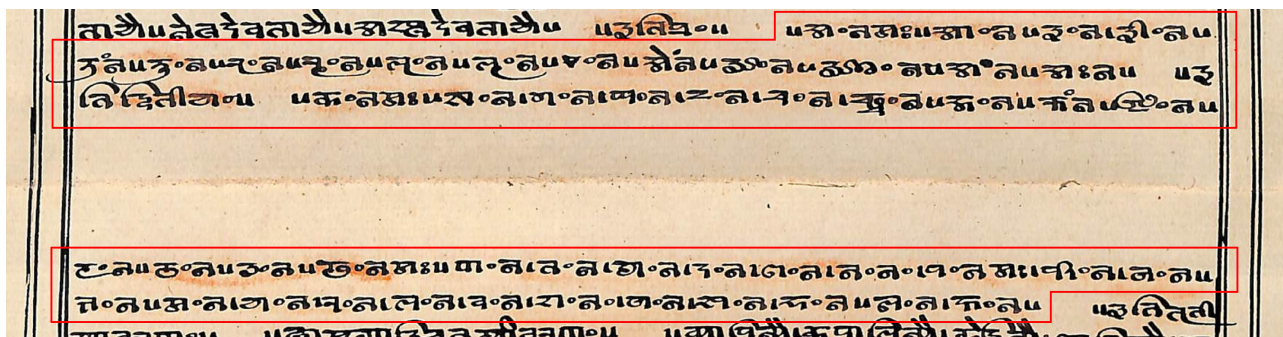


Figure 2: Nandinagari character inventory in a folio written in an ornate style.

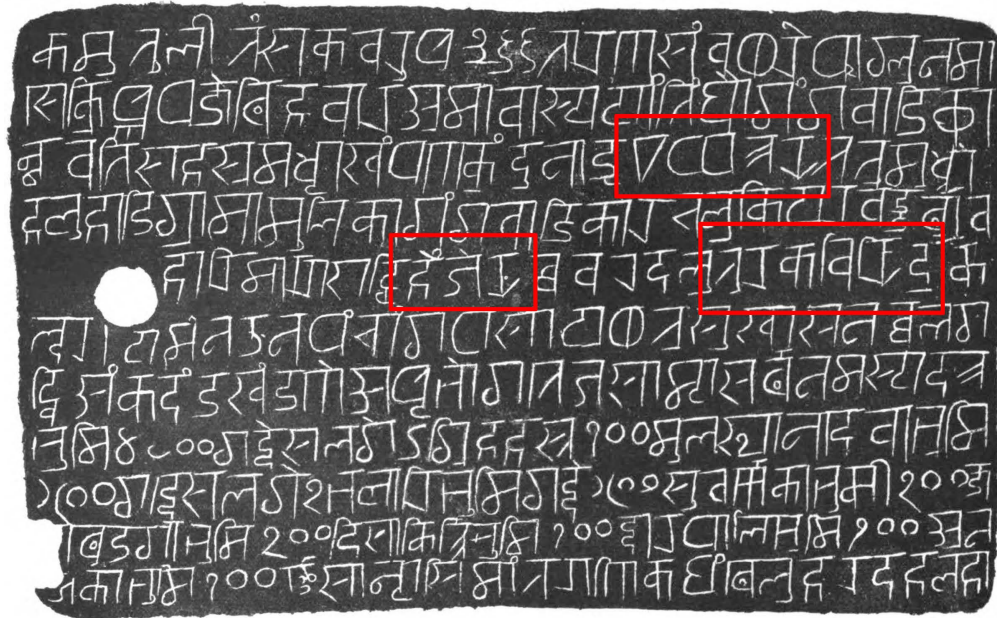
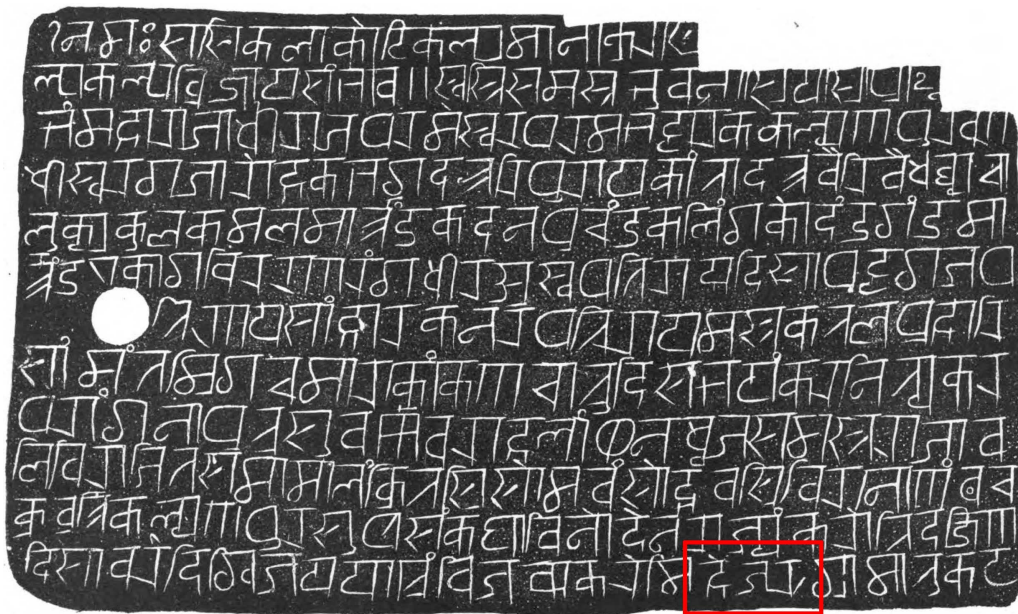


Figure 3: Copper plate of Vīraṇaṇṁba bearing a grant inscribed in Nandinagari, Saka 366 (from Rice 1879, plates 1, 2). The letter RA occurs in the name of the village Henjara (*heṃjara-grāmā*) and in the phrases *eppattara* and *turakaviridu*.

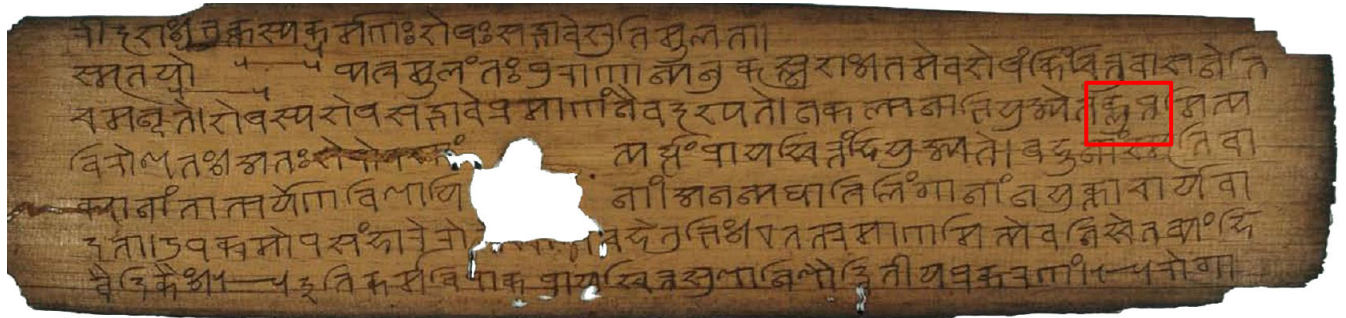


Figure 4: Representation of /l/ using a conjunct of के KA + ले LA in the word kṛpta.

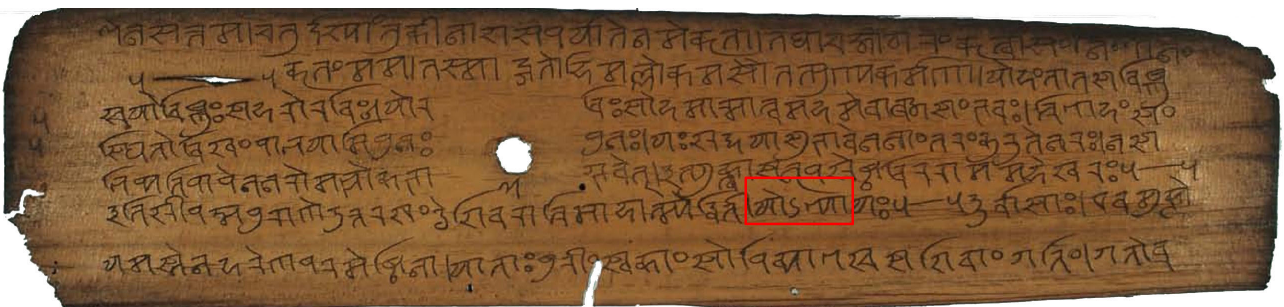
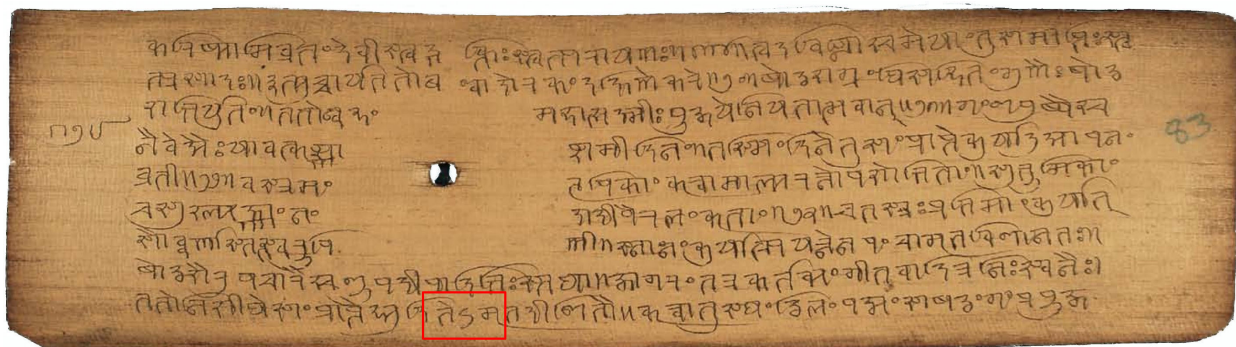


Figure 5: Nandinagari folios showing usage of S NANDINAGARI SIGN AVAGRAHA.

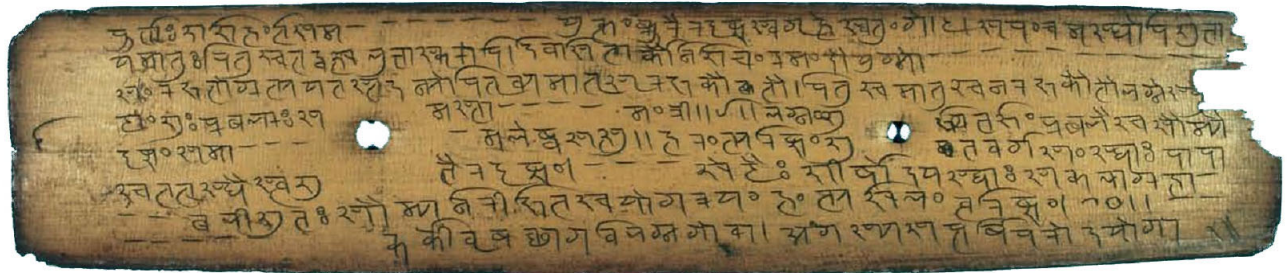
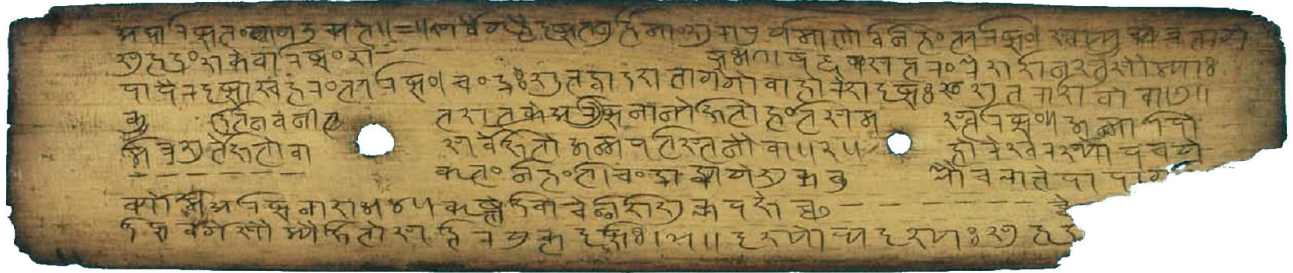


Figure 6: Usage of the $\bar{\text{NANDINAGARI HEADSTROKE}}$ for spacing (from *Jyotisham Vastulakshanam*, IFP no. RE33587).

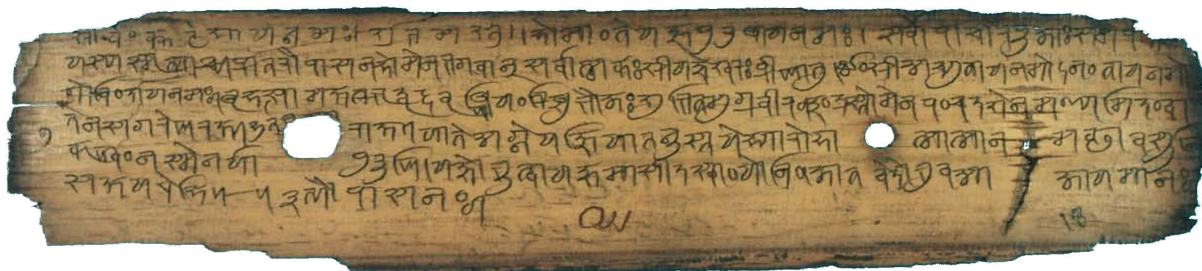
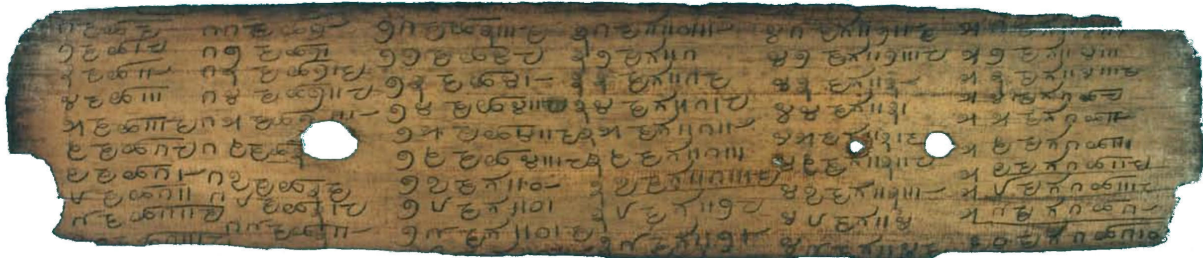


Figure 7: Usage of digits and fraction signs in Nandinagari (from *Jyotisham Vastulakshanam*, IFP no. RE33587).

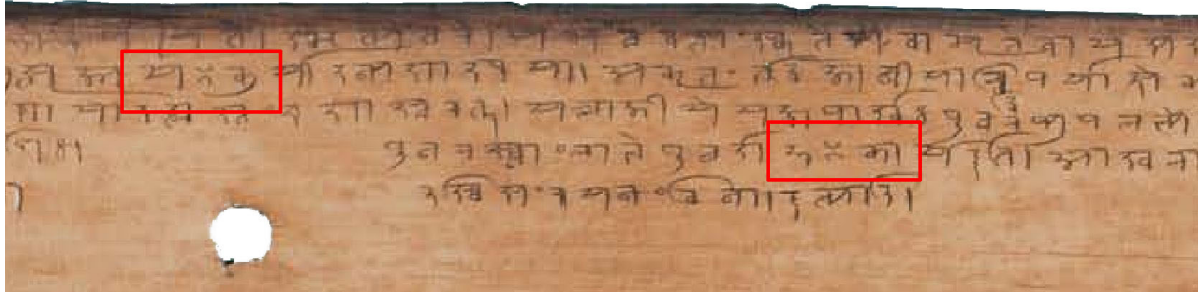


Figure 8: Usage of *jihvāmūlīya* in Nandinagari.

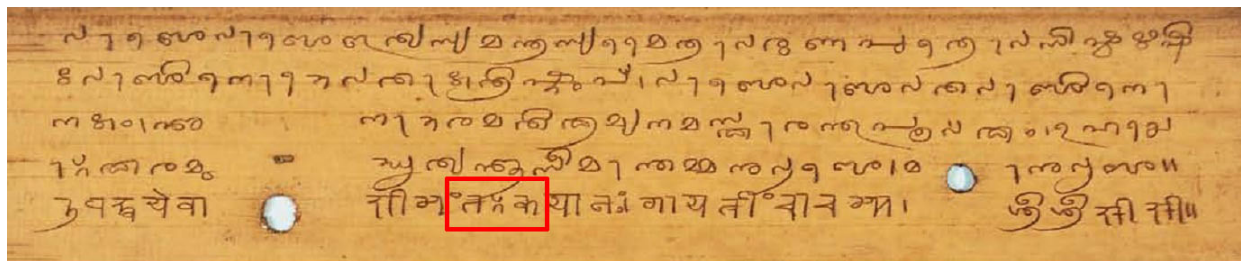


Figure 9: Usage of *jihvāmūlīya* in Nandinagari.

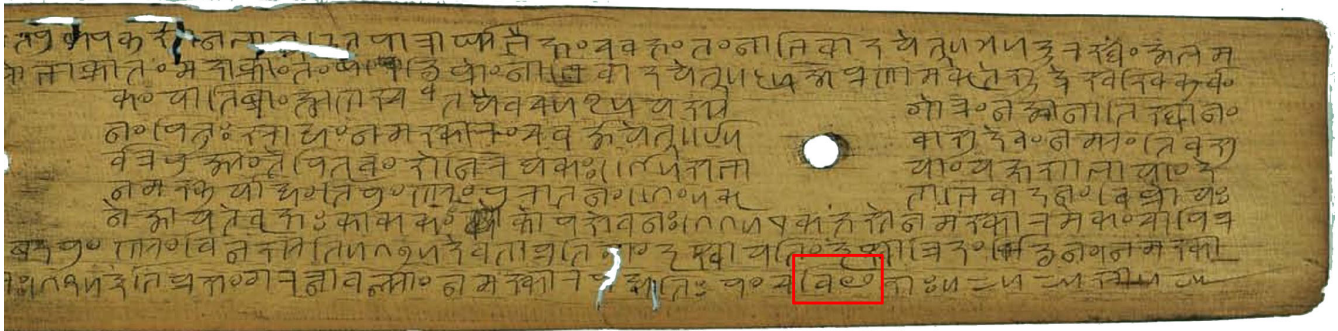


Figure 10: Usage of 𑀓 U+1CE9 VEDIC SIGN ANUSVARA ANTARGOMUKHA in Nandinagari.

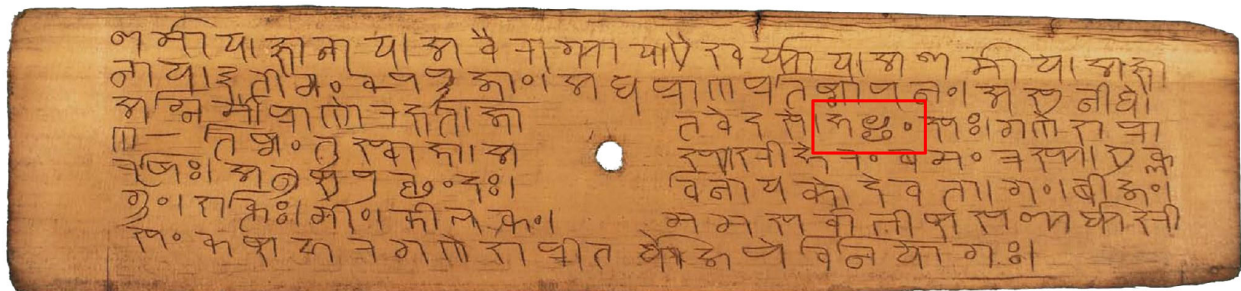


Figure 11: Usage of the sign 𑀓𑀓 in 𑀓𑀓. This sign is a double stack of 𑀓 U+1CE9 VEDIC SIGN ANUSVARA ANTARGOMUKHA, and has been proposed for inclusion in the ‘Vedic Extensions’ block as VEDIC SIGN DOUBLE ANUSVARA ANTARGOMUKHA.

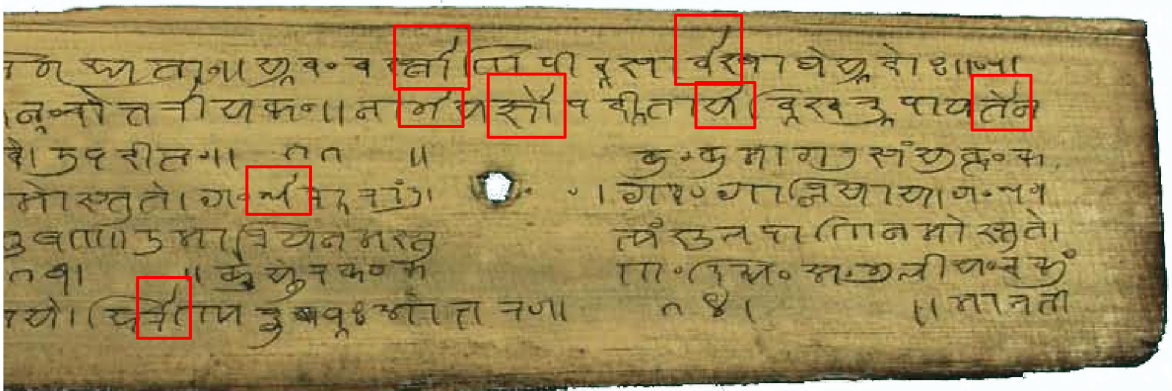
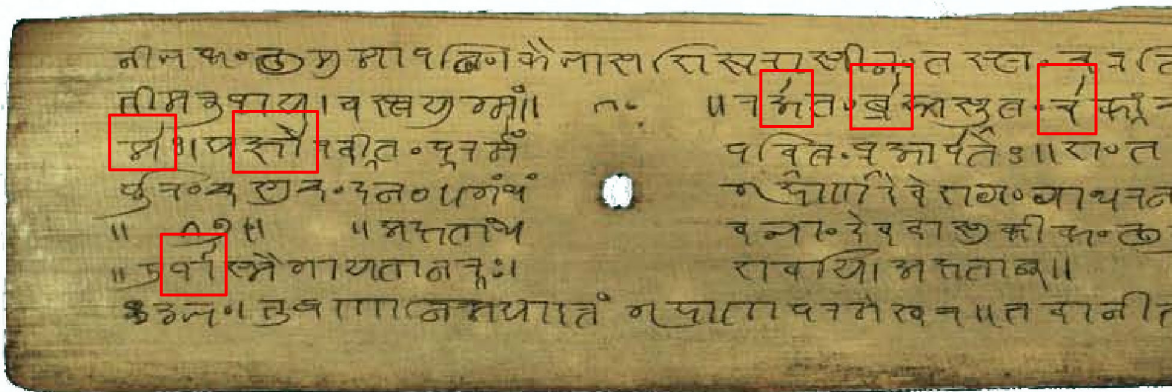


Figure 12: Usage of the Vedic intonation sign ◌̣ svarita in Nandinagari.

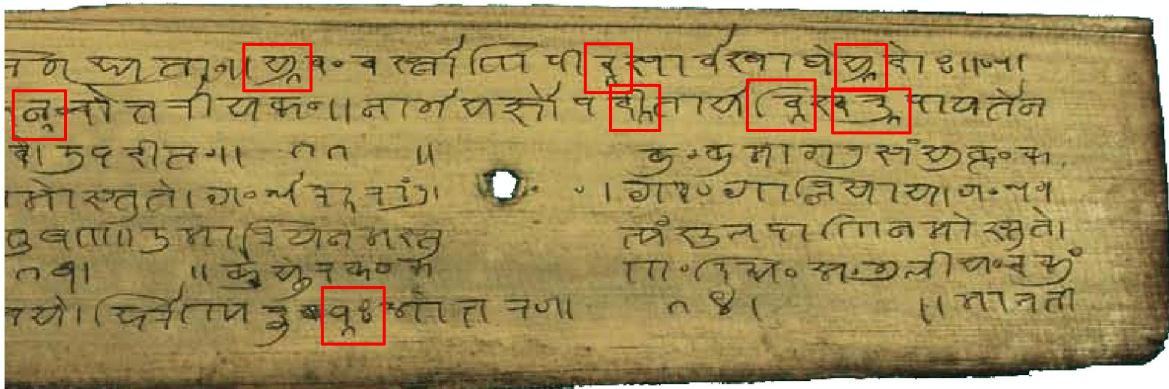
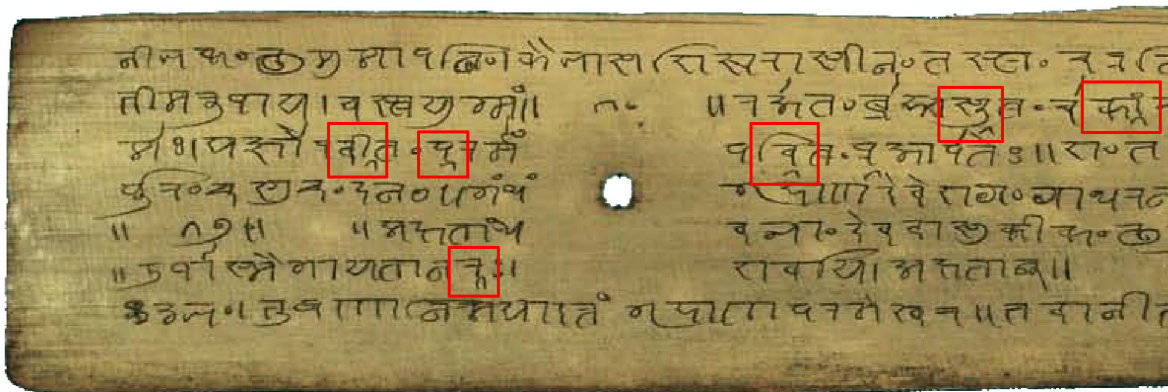


Figure 13: Usage of the Vedic intonation sign ॐ *anudatta* in Nandinagari.

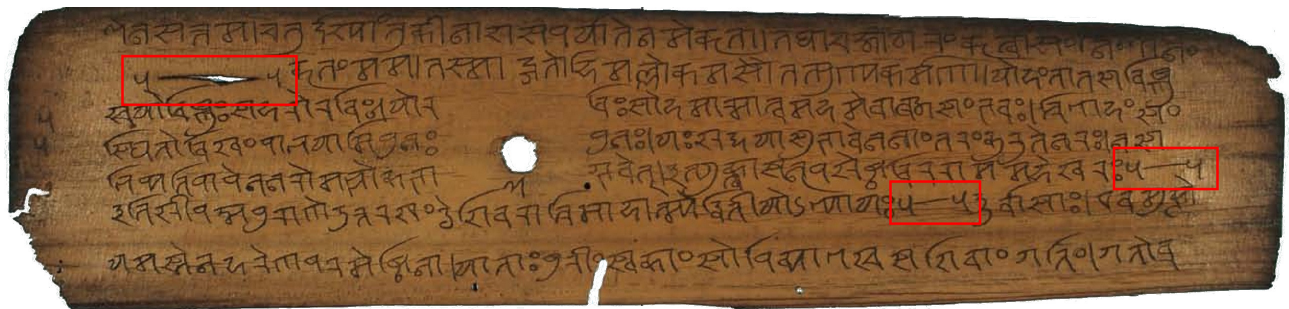


Figure 14: Folio showing usage of a U filler and — HEADSTROKE for marking gaps. The sign U is not currently proposed for encoding.

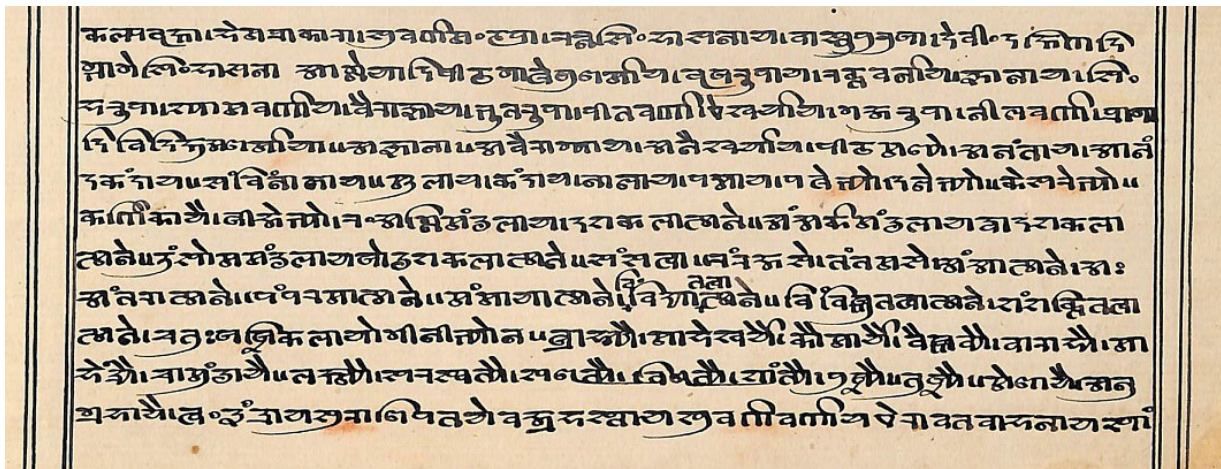


Figure 16: Example of a style of Nandinagari written in ink, which differs from the style used on palm leaves, as shown in the preceding figures.



Figure 17: A coin of Krishnadevaraya, the emperor of Vijayanagara (r. 1509–1530), with the inscription “*srīkṛṣṇarāya*” in Nandinagari on the reverse.

The Krāku Grant of Harihara II - Plate XXXV

Śaka 1298 (A.D.1376/1377)

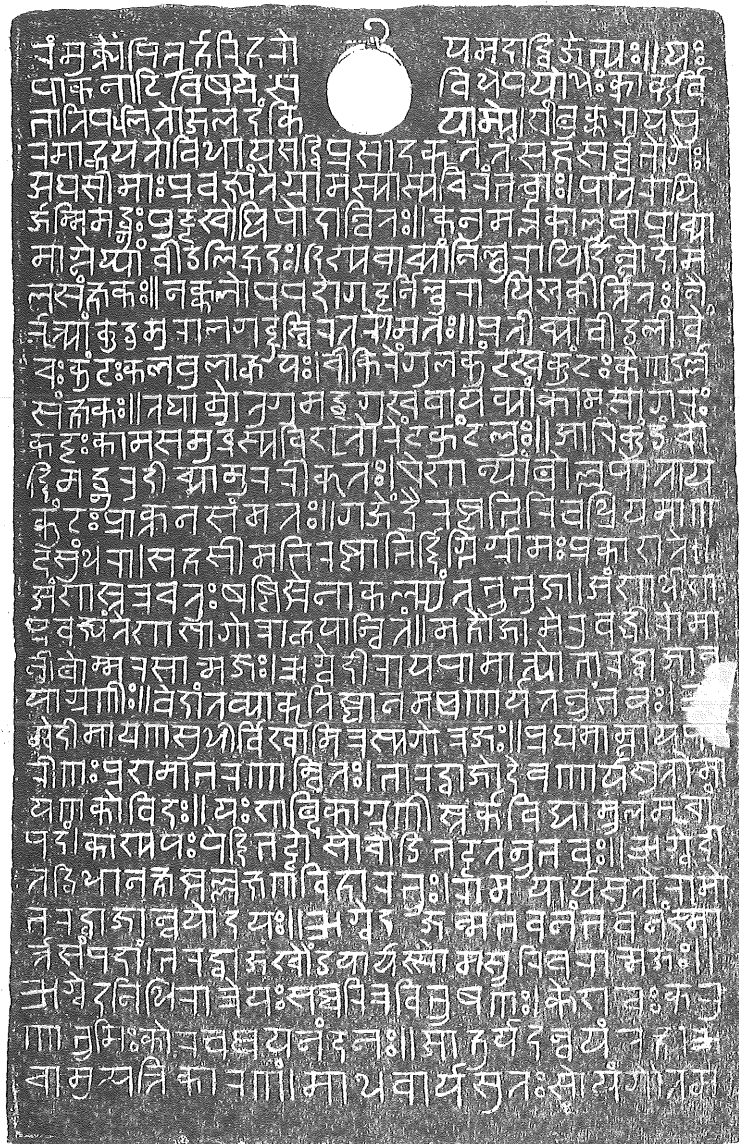


Figure 18: A plate containing a record in Nandinagari (from Visalakshy 2003: 266).

Nandinagari script नन्दिनागरी नन्दिनागरी लिपि

Vowels स्वराः स्वराः

अ	आ	इ	ई	उ	ऊ
a अ	ā आ	i इ	ī ई	u उ	ū ऊ
ऋ	ॠ	ए	ऐ	ओ	औ
r ऋ	r̄ ॠ	e ए	ai ऐ	o ओ	au औ

Consonants वामानि व्यञ्जनानि

क	ख	ग	घ	ङ
ka क	kha ख	ga ग	gha घ	ṅa ङ
च	छ	ज	झ	ञ
ca च	cha छ	ja ज	jha झ	ña ञ
ट	ठ	ड	ढ	ण
ṭa ट	ṭha ठ	ḍa ड	ḍha ढ	ṇa ण
त	थ	द	ध	न
ta त	tha थ	da द	dha ध	na न
प	फ	ब	भ	म
pa प	pha फ	ba ब	bha भ	ma म
य	र	ल	व	श
ya य	ra र	la ल	va व	śa श
ष	स	ह	ळ	र
ṣa ष	sa स	ha ह	ḷa ळ	ra र

Figure 19: Handwritten chart of Nandinagari characters (courtesy of Srinidhi A., Tumkur, Karnataka).

Vowel signs

क का कि की कु कु क् क् के कै को को
ka kā ki kī ku kū kṛ kṛ ke kai ko kau

Various signs

Anusvara- ँ Visarga- ः Ardhavisarga- ऌ

Avagraha- ः Vedic Anusvaras- ऌ, ऍ

Virama- ः

क-क, ग-ग, त-त, न-न, त्-त्

Digits (Kannada digits)

० १ २ ३ ४ ५ ६ ७ ८ ९

0 1 2 3 4 5 6 7 8 9

Variants

झ - झ, झ

चे - चो

ष - ष

ऌ - ऌ

ॠ - ॠ

ॡ - ॡ

घ - घ

ण - ण, थ

फ - फ, फ

ब - ब, ब

म - म

ष - ष, ष

स - स, स

ो - ो

ी - ी

ी - ी

ी - ी

७ - ७

Figure 20: Handwritten chart of Nandinagari characters (courtesy of Srinidhi A., Tumkur, Karnataka).

Consonant conjuncts in Nandinagari script

<u>k-</u>			knya	क्ये		kṣva	क़े
kka	कक, क्क		kpa	कप		ksa	कसे, कस
kkra	कक्र		kpra	कप्र		ksta	कस्त
kkla	ककल		kpla	कपल		kstra	कस्तल
kkva	ककव		kpha	कफ		kstha	कस्थ
kkha	ककष		kma	कमे, कम		ksna	कस्तन
kca	कके		knya	कने		kspa	कसप
kcha	ककेच		kya	का		kspa	कसफ
кта	ककल		kra	क्रे		kspna	कसफने
kya	कके		knya	कने		kma	कसम
क्ता	कके, कने		kla	कले		ksya	कसय
kyā	कके		klya	कले		ksra	कसय
क्त्रा	कके		kva	कके, कवे		kṣva	कक़े
कत्र्या	कके		kṣa	कक़े		<u>kh-</u>	
क्त्रवा	कके		kṣa	कक़े		khkha	कखक
क्त्रव्या	कके		kṣna	कक़े		khna	कखन
ktha	ककथ		kṣnya	कक़े		khya	कखय
kthna	ककथन		kṣma	कक़े		khva	कखव
kthya	ककथय		kṣma	कक़े		<u>ḡ-</u>	
kna	ककने		kṣmya	कक़े		ḡga	कक़े, कक़े
			kṣya	कक़े		ḡḡa	कक़े
			kṣra	कक़े		ḡgha	कक़े
						ḡghya	कक़े

Figure 21: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

gghna	गघ		grya	ग्र्या		c-	
gja	गज		grva	ग्रव		cca	वृ
gja	गजा		gla	गल		cca	वृ
giva	गिवा		gva	गव		ccha	वृ
gda	गद		gvya	गव्या		cchya	वृ
gda	गद		gvra	गव्रा		cchra	वृ
gdya	गद्या					cchla	वृ
gdra	गद्र		gh-			cchva	वृ
gdva	गद्व		ghgha	गघ		cma	वृ
gdvya	गद्व्या		ghna	गन		cna	वृ
gdha	गदह		ghnya	गन्या		cya	वृ
gdhra	गदह्र		ghma	गम		cra	वृ
ghaya	गहा		ghya	गघ्या		cva	वृ
gdhva	गदह्व		ghra	ग्र			
gna	गन		ghrya	ग्र्या		j-	
gnya	गन्या		ghva	गव		ija	गं, गन
gba	गब		ghvya	गव्या			
gbha	गभ		i-			ijna	गं
gbhya	गभ्या		rita	रि		ijya	गं
gbhra	गभ्र		rina	रि		ijva	गं
gma	गम		riya	रि		ijha	गं
gmya	गम्या		rma	रम, रम		ina	गं
gya	ग्या		niva	रं			
gra	ग्र						

Figure 22: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

ḷḷya	ḷḷ	tḷra	ḷḷ,	ḷḷḷa	ḷḷḷ
ḷḷva	ḷḷḷ	tḷva	ḷḷ	ḷḷya	ḷḷḷ
jma	ḷḷ	tḷpa	ḷḷ	ḷḷḷa	ḷḷḷ
jmya	ḷḷḷ	tḷpra	ḷḷ	ḷḷḷya	ḷḷḷḷ
jya	ḷḷ	tḷpha	ḷḷḷ	ḷḷḷva	ḷḷḷḷ
jva	ḷḷḷ	tḷma	ḷḷḷ	ḷḷḷa	ḷḷḷ
jḷya	ḷḷḷ	tḷya	ḷḷ	ḷḷḷva	ḷḷḷḷ
jva	ḷḷḷ	ḷra	ḷḷ	ḷḷba	ḷḷḷ,
jḷya	ḷḷḷ	tḷva	ḷḷḷ,	ḷḷbha	ḷḷḷ,
t-		tḷḷa	ḷḷ	ḷḷbha	ḷḷḷ,
tka	ḷḷ,	tḷsa	ḷḷḷ	ḷḷbhya	ḷḷḷ
	ḷḷḷ	tḷsa	ḷḷḷ	ḷḷma	ḷḷḷ
tkra	ḷḷ	tḷva	ḷḷḷ	ḷḷya	ḷḷḷ
tca	ḷḷ	tḷh-		ḷḷra	ḷḷḷ
tcha	ḷḷḷ	tḷhya	ḷḷḷ	ḷḷla	ḷḷḷḷ
tḷa	ḷḷ,	ḷ-		ḷḷva	ḷḷḷḷ,
	ḷḷḷ	ḷḷ	ḷḷḷḷ	ḷḷya	ḷḷḷḷ
	ḷḷḷ	ḷḷya	ḷḷḷḷ	ḷḷh-	ḷḷḷḷ
	ḷḷḷ	ḷḷra	ḷḷḷḷ	ḷḷhya	ḷḷḷḷ
	ḷḷḷ	ḷḷgha	ḷḷḷḷ	ḷḷra	ḷḷḷḷ
tḷa	ḷḷḷ	ḷḷa	ḷḷḷḷ		

Figure 23: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

dhva	धु		ttma	तम		trva	त्र
n-			ttya	तय		tva	त्व, व
nna	नन		ttra	त्रे त्र		tvya	व्य
nna	न्र		ttrya	त्र्य		tsa	स
nma	नम, मम		ttva	त्र		tska	स्क
nya	नय, मय		tsa	स		tskha	सख
nva	नव		ttha	थ		tsta	सत
nvya	नव्य		tthya	थ्य		tstra	सत्र
t-			tna	न		tstha	सथ
tka	क		tnya	न्य		esthya	सथ्य
tkya	क्य		tnva	नव		tsna	सन
tkva	कव		tpa	त		tspa	सप
tkla	कल		tpra	त्र		tspra	सप्र
tkva	कै		tpla	तल		tspha	सफ
tksa	कस		tpha	तफ		tsphya	सफ्य
tkṣma	कṣम		tna	न		tsma	सम
tkṣva	कṣव		tmya	म्य		tsya	स्य
tka	तस, स		tya	त		tsra	स्र
tkhya	सथ		tyva	तव		tsa	स
tta	त		tpa	त, त्र		th-	
ttna	तन		trya	त्र		thna	थन
						thnya	थन्य
						thya	थ्य

Figure 24: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

thra	𑌔	dna	𑌎	dhya	𑌧
thva	𑌕	dva	𑌏	dhra	𑌨
d-		dvra	𑌐	dhrya	𑌩
dga	𑌖	dbha	𑌑	dhva	𑌪
dgra	𑌗	dbhya	𑌒	dhrya	𑌫
dglā	𑌘	dbhra	𑌓	dhvra	𑌬
dghē	𑌙	dhva	𑌔	n-	
dghra	𑌚	dma	𑌕	nka	𑌭
dghra	𑌛	dmya	𑌖	nkra	𑌮
dda	𑌜	dya	𑌗	nkla	𑌯
ddya	𑌝	dra	𑌘	nkva	𑌰
ddra	𑌞	drya	𑌙	nkṣa	𑌱
ddva	𑌟	drva	𑌚	nkha	𑌲
ddha	𑌠, 𑌡, 𑌢, 𑌣, 𑌤, 𑌥	dva	𑌛	nknya	𑌳
ddhma	𑌦	dvya	𑌜	nga	𑌴
ddhya	𑌧	dvra	𑌝	ngha	𑌵
ddhva	𑌨	dh-		nna	𑌶, 𑌷
ddhva	𑌩	dhra	𑌧	nnya	𑌸
ddhva	𑌪	dhdha	𑌨	nnva	𑌹
ddhva	𑌫	dhnya	𑌩	npa	𑌺
ddhva	𑌬	dhma	𑌪	npva	𑌻

Figure 25: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

npla	नप्ल			pma	पू
npsa	नपस	nsna	नस	pya	प
npha	नपि	nspa	नसप	pra	प्र
nba	ब	nsma	नसम	prya	प्र
nbra	ब्र	nsya	नस	pla	प्र
nbha	भ	nsra	नस	pva	व
nbhra	भ्र	nsva	नसव	psa	स
nma	म	nha	नह	psa	स
nmya	म	p-		psna	स
nmra	म	pka	क	psnya	स
nmla	म	pca	व	psya	स
nya	न	pccha	वृ	psva	स
nyva	न	pta	प	b-	
nra	र	pna	न	bga	ग
nva	व	pta	न,त	bgra	ग
nvya	व	ptya	त	bja	ज
nvna	व	ptrya	त		क
nsa	स	ptva	त	bija	ज
nsa	स	pna	न	bda	द
nska	सक	pnya	न	bdya	द
nsta	स	ppa	प	bdhva	द
nstha	स,थ	ppra	प	bdhya	द
	सथ	pph	प		

Figure 26: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

bhva	बव	bhva	बव	l	ल
bba	बब	bhva	बव	lKa	लक
bbra	बब	m-		lkya	लक्या
bbha	बब	mṅa	मं	lga	लगा
bbhya	बब	mna	मंन	lgya	लग्या
bhya	ब	mṅya	मंय	lgya	लग्या
bra	ब	mna	मंन	lpa	लप
bla	ब	mmya	मंय	lpya	लप्या
bva	व	mmra	मंम	lba	लब
bva	व	mmba	मंम	lba	लब
bva	व	mmya	मंय	lba	लब
bva	व	mra	मं	lba	लब
bh-		mrya	मंय	lba	लब
bhma	भम	mra	मं	lba	लब
bhṅa	भं	mra	मं	lba	लब
bhna	भन	mra	मं	lba	लब
bhya	भ	mra	मं	lba	लब
bha	भ	mra	मं	lba	लब
bhṅya	भंय	mra	मं	lba	लब
bhrva	भ्रव	mra	मं	lba	लब
bhla	भ्ल	mra	मं	lba	लब
		ya-		lba	लब
		yya	य्य	v-	व
		yva	यव	vna	व्न
		r-		vna	व्न
		reph	रिः	vna	व्न
		rka	रिः	vna	व्न

Figure 27: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

vya	व्या	ऽ-		ऽra	र	ssa	सस
vra	व्रा	ऽka	क	ऽva	व	ssya	सस्य
vla	व्ला	ऽkya	क्या	s-	स	ssva	ससव
wa	व्व, वव	ऽkra	क्र	ska	स्क	h-	
ś-		ऽkla	क्ल	sta	स्त	hna	ह्न
śca	श्च	ऽkva	क्व	stma	स्म	nna	न्न
ścya	श्च्य	ऽsta	स्त	stya	स्त्या	hnya	ह्न्या
ścha	श्चु	ऽtja	त्ज	stya	स्त्य	hna	ह्न
śna	श्न	ऽtja	त्जा	stya	स्त्या	hmya	ह्न्या
śnya	श्न्या	ऽtra	त्र	stya	स्त्या	hya	ह्य
śpa	श्प	ऽtrja	त्रज	stva	स्त्व	hra	ह्र
śma	श्म	ऽtrja	त्रज	stha	स्थ	hla	ह्ल
śmya	श्म्या	ऽtrja	त्रज	stha	स्थ	hva	ह्व
śya	श्या	ऽna	न	stha	स्थ	hva	ह्व
śra	श्र	ऽnya	न्या	stha	स्थ	l-	
śrya	श्र्या	ऽnva	न्या	sna	स्न	lga	लग
śrva	श्रव	ऽpa	प	sna	स्न	ly	ल्य
śla	श्ल	ऽpa	प	spa	स्प	lka	लक
śva	श्व	ऽpya	प्या	spra	स्प	lila	ल्ल
śvya	श्व्या	ऽpra	प्रा	spha	स्फ		
śśa	शशा	ऽpla	प्ल	sphya	स्फ्या		
		ऽpva	पव	sma	स्म		
		ऽpha	फ	smya	स्म्या		
		ऽma	म	sya	श्या		
		ऽmya	म्या	sya	श्या		
		ऽya	या	sya	श्या		
				sva	स्व		
				svya	स्व्या		

Figure 28: Handwritten table of Nandinagari conjuncts (courtesy of Srinidhi A., Tumkur, Karnataka).

CHAPTER II
ALPHABETS AND NUMERALS

Nandināgarī has twelve vowel letters and thirty five consonant letters. The number excludes 'a' with anusvāra and 'a' with visarga. In the inventory of Nandināgarī alphabets 'kṣa' and 'jña' are treated as single letters. In the case of the letter for 'kṣa' it does not show any apparent resemblance with the letters of ka and ṣa. However, in the case of 'jña' it has some resemblance with the letter ja. The letter for 'ba' is very often used to represent 'va' and the letter for 'sa' is commonly used to represent 'śa'. Since a few instances are noticed where sa-śa and ba - va are distinguished by separate letters, all the four are included in the inventory of letters.

VOWELS

There exists only four basic vowel letters. The other letters representing vowels are only derivations. These four primary vowel letters are those which represent a, i, u and e. The long vowels ā, ī, and ū are derived by the use of subsidiary symbols. The vowels ṛ and ṝ are derived from the consonant letters 'ra' and 'la'. The letters for long vowels ṝ and ṝ̄ are absent. The diphthong 'ai' is formed by the use of subsidiary symbol with the letter for the vowel 'e', the letters for 'o' and 'au' are formed by adding subsidiary symbols to the letter 'ā'. The vowels of Nandināgarī script are given below.

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
अ	A	अ
आ	Ā	आ
इ	I	इ

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
ओ	O	ओ
औ	AU	औ

CONSONANTS

The basic consonant letters of Nandināgarī, similar to that of other Indian scripts, indicate the consonant + the vowel 'a'. As in Devanāgarī, letters are found for all the varga consonants. When a pure consonant i.e. without any vowel is to be represented, a separate subsidiary symbol which is identical with the symbol in the Devanāgarī script is found to be in use. Eg. (k), (c), (t). The consonant letters are as follows:

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
क	KA	क
ख	KHA	ख
ग	GA	ग

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
ई	Ī	ई
उ	U	उ
ऊ	Ū	ऊ
ऋ	Ṛ	ऋ
ॠ	Ṝ	ॠ
ए	E	ए
ऐ	AI	ऐ

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
घ	GHA	घ
ङ	ṄA	ङ
च	CA	च
छ	CHA	छ
ज	JA	ज
झ	JHA	झ
ञ	ṆA	ञ

Figure 29: Charts showing basic characters of Nandinagari (from Visalakshy 2003: 20–23).

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
ॠ	ṬA	ट
ॡ	ṬHA	ठ
ॢ	ḌA	ड
ॣ	ḌHA	ढ
॥	ṆA	ण
त	TA	त
थ	THA	थ

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
द	DA	द
ध	DHA	ध
न	NA	न
प	PA	प
फ	PHA	फ
ब	BA	ब
भ	BHA	भ

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
म	MA	म
य	YA	य
र	RA	र
ल	LA	ल
व	VA	व
श	ŚA	श
ष	ṢA	ष

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
स	SA	स
ह	HA	ह
क्ष	KṢA	क्ष
ज्ञ	JṆA	ज्ञ

ANUSVĀRA AND VISARGA

Anusvāra	◌̣
Visarga	◌̇

Figure 30: Charts showing basic characters of Nandinagari (from Visalakshy 2003: 24–27).

]. For the combination of the vowel 'i' with consonants, instead of a separate subsidiary symbol the letter for 'i' itself is used.

Subsidiary Symbols of Vowels:

SUBSIDIARY SYMBOL (NANDINĀGARĪ)	VOWEL REPRESENTED	DEVANĀGARĪ
𑌗	Ā	आ
𑌘	I	इ
𑌙	Ī	ई
𑌚	U	उ
𑌛	Ū	ऊ
𑌜	Ṛ	ऋ

SUBSIDIARY SYMBOL (NANDINĀGARĪ)	VOWEL REPRESENTED	DEVANĀGARĪ
𑌝	E	ए
𑌞	AI	ऐ
𑌟	O	ओ
𑌠	AU	औ

Letters Representing Consonant Vowel Combinations

Though 'r' does not occur with all consonants, its combination with consonants is not very much restricted and also has a regular pattern. Hence all C+r combinations are given. Only very few examples are found for the occurrence of consonant +vowel 'l'.

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
𑌡	KA	क

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
𑌢	KĀ	का
𑌣	KI	कि
𑌤	KĪ	की
𑌥	KU	कु
𑌦	KŪ	कू
𑌧	KṚ	कृ
𑌨	Kḷ	क्लृ

NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
𑌩	KE	के
𑌪	KAI	कै
𑌫	KO	को
𑌬	KAU	कौ
𑌭	KHA	ख
𑌮	KHĀ	खा
𑌯	KHI	खि

Figure 31: Dependent vowel signs in Nandinagari (from Visalakshy 2003: 30–33).

NUMERALS

In order to represent numerals, Nandināgarī uses ten symbols. They are as follows:

NANDINĀGARĪ	ROMAN	NANDINĀGARĪ	ROMAN
०	0	𑌵	5
𑌶	1	𑌶	6
𑌷	2	𑌷	7
𑌸	3	𑌸	8
𑌹	4	𑌹	9

The combination of these symbols derive higher numerals. The patterns of combinations are same as in Devanāgarī. The following are some examples:

NANDINĀGARĪ	ROMAN	NANDINĀGARĪ	ROMAN
𑌶𑌵	10	𑌶𑌵𑌵𑌵	1000
𑌶𑌶	11	𑌷𑌷𑌸𑌵	2235

Figure 32: Nandinagari digits (from Visalakshy 2003: 86).

CHAPTER VII
VARIANTS

Some variant letters/symbols noticed in Nandināgarī are given here. Some of the variants may be due to the interference of other writing systems such as Devanāgarī.

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
उ	उ	u	उ
रु	रु	r	ऋ
वे	वे, वे	e	ए
वे	वे, वे	ai	ऐ
कु	कु	ku	कु

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
कु	कु, कु	kū	कू
क्र	क्र	kra	क्र
ख	ख, ख	kha	ख
चा	चा	cā	चा
चि	चि	ci	चि
छ	छ, छ, छ	cha	छ

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
ठ	ठ	ṭha	ठ
ल	ल	tna	ल
त्र	त्र, त्र	tra	त्र
त्व	त्व	tva	त्व
द्य	द्य	dya	द्य
ध	ध, ध, ध, ध, ध	dha	ध

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
प	प	pa	प
प्प	प्प	ppa	प्प
फ	फ, फ	pha	फ
ब	ब, ब	ba	ब
भू	भू	bhū	भू
म	म, म, म	ma	म

Figure 33: Glyphic variants in Nandinagari (from Visalakshy 2003: 235–238).

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
य	य	ya	य
र	र	ra	र
रु	रु	rū	रु
ल	ल	la	ल
ल	ल	rla	ल

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
ष	ष	ṣa	ष
ष्ट	ष्ट	ṣṭa	ष्ट
श्री	श्री	śrī	श्री
ज्ञ	ज्ञ	jñā	ज्ञ
०(Anusvāra)	०	ṁ	०

Nandināgarī		Letter Represented	
Regular Form	Variant Form	Roman	Devanāgarī
२	२	2	२
६	६	6	६
७	७	7	७
९	९	9	९

Figure 34: Glyphic variants in Nandinagari (from Visalakshy 2003: 235–238).

The following letters show close resemblance and care is required to distinguish them.

	NANDINĀGARĪ	ROMAN	DEVANĀGARĪ
SET I	३	I	इ
	उ	U	उ
	३	DA	ड
	३	JA	ज
SET II	७	JHA	झ
	७	RA	र

	ROMAN	DEVANĀGARĪ	NANDINĀGARĪ
SET III	७	TA	त
	७	BHA	भ
SET IV	३	NA	ड
	३	DA	द
SET V	७	PA	प
	७	YA	य

CONSONANT VOWEL COMBINATIONS

As already pointed out, the basic consonant letter represents the combination of consonant and the vowel 'a'. All the other vowel combinations with the consonants are represented by using subsidiary symbols with the basic consonant letter except in the case of

Figure 35: Internal 'confusables' in Nandinagari (from Visalakshy 2003: 28–29).

Appendix: Distinctive Features of Nandinagari

<i>Vowels</i>	<i>Initial</i>	<i>Diacritic</i>	<i>k-Ligatures</i>
a	अ & आ & ए		क
ā	आ & आ & आ	◻	का
i	इ & ई	◻ & ◻ & ◻	कि & कि & कि
ī	ई & ई	◻	की
u	उ & ऊ	◻	कु
ū	ऊ & ऊ	◻	कू
r	र (=“rr”)	◻	कृ
r̄	र̄ (=“r̄r̄”)	◻	कृ
l	(not documented)	◻	कृ
l̄	(not documented)		
e	ए & ए	◻	के
ai	ऐ & ऐ	◻	कै
o	ओ & ओ	◻	को
au	औ	◻	कौ

Figure 36: Distinctive features of Nandinagari (from Grünendahl 2001: 201).

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APPENDIX

*Consonants: Velar**Retroflex*

ka	क	ṭa	ट & ट & ट
kha	ख & ख	ṭha	ठ & ठ & ठ (cf. ḍha)
ga	ग & ग & ग & ग & ग	ḍa	ड & ड
gha	घ & घ	ḍha	ढ
ṅa*	ङ	ṅa	ण

*Palatal**Dental*

ca	च & च	ta	त
cha	छ & छ & छ (cf. ccha)	tha	थ & थ
ja	ज & ज	da	द & द
jha†	झ	dha	ढ & ढ & ढ
ña	(not documented)	na	न

* interpolated from conjuncts

† to be distinguished from ञ ru

Figure 37: Distinctive features of Nandinagari (from Grünendahl 2001: 202).

NANDINAGARI		203	
<i>Labial</i>		<i>Sibilants</i>	
pa	प & प	śa	री & री
pha	फ़ & फ़	ṣa	ष & ष
ba	ब	sa	री & री
bha	त & त		
ma	म		
<i>Sonorants</i>		<i>Other</i>	
ya	य & य & प & प & ण	ha	रु & रु
ra	र	la	ल
la	ल & ल		
va	व & व		

Figure 38: Distinctive features of Nandinagari (from Grünendahl 2001: 203).

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APPENDIX

Additional Graphs○ *-ṁ (anusvāra)*ॐ *-ñ (anunāsika)*ः & ृ *-ḥ (visarga)*ॐ *avagraha*◻ & ◻ *virāma, e.g. -ṭ ॢ -t ॣ & ।*◻ & ◻ & ◻ *Vedic accents (preceding accented syllables)*ॐ *om**Numerals (cf. pp. 138, 180)*

○	॑	॒ & ॒ & ॑ & ॑	क़	ख़ & ख़
1	2	3	4	5
ॆ & ॆ	े & े	ै & ै	ॉ & ॉ	ॐ
6	7	8	9	0

Figure 39: Distinctive features of Nandinagari (from Grünendahl 2001: 204).

Conjuncts

kka	क	gga	ग
kca	क	gna	ग
kta	क	gya	ग
ktyā	क	gra	ग
ktra	क	gla	ग
ktva	क	ghna	ग
ktha	क		
kya	क		
kra	क	ñ- usually appears as anusvāra	
kla	क	ñmu	क
kṣa	क	kṣū	क
kṣma	क	cca	क
kṣmyā	क	ccha	क (cf. cha) क
kṣya	क	cchṛ	क (also for cchru)
		cchva	क
khya	क	cya	क

Figure 40: Distinctive features of Nandinagari (from Grünendahl 2001: 205).

206		APPENDIX		
cyu	चु		dhva	धु
cra	च			
			ṅya	ण्य ण
jjha	ज्ज		ṅva	ण्व
jña	ज्ञ			
jñya	ज्ञ्य		tka	कू तकु कु
jya	ज्य ज		tta	तू त
jyo	ज्यो ज्यो		tna	तू
jva	ज्व		tpa	पू तपू
			tpra	तपू
			tpha	तपू
			tma	तू
ṭya	ट्य		tmya	त्यू
ṭva	ट्व		tya	त्यू
			tra	तू
ḍya	ड्य		trya	त्यू

Figure 41: Distinctive features of Nandinagari (from Grünendahl 2001: 206).

		NANDINAGARI			
tva	व			dhva	ध्व ध
t	त	त्	त्		
tsa	त्सा	त्सा			
tsya	त्स्या			nta	न्त न्त
tsva	त्सव			nma	न्म
				nya	न्य न्यु न्य
dga	ङ			nva	न्व
dda	ङ्	द्दु	ङ्ग		
ddha	ङ्ह	छ	झ	pta	प्त
dba	ड			pna	प्न
dbra	ड्र			pno	प्नो प्नो
dma	डम			pra	प्र प
dya	ड्य	ड्यु	ड्य		
dra	ड्र	ड्र		bda	ब्द
dva	ड्व			bra	ब्र
dhya	ध्या धा			bhya	भ्या

Figure 42: Distinctive features of Nandinagari (from Grünendahl 2001: 207).

208		APPENDIX	
bhra	𑂒	vya	𑂗
		vra	𑂘
mpa	𑂙		
mya	𑂚	śca	𑂛
mra	𑂛	śna	𑂜
		śya	𑂝
yya	𑂞 𑂟	śra	𑂞
		śrī	𑂟 𑂠
rda	𑂡	śva	𑂡
rma	𑂢		
rya	𑂣	ṣka	𑂤 𑂥
rṣa	𑂦	ṣkr	𑂦
rṣe	𑂧	ṣta	𑂧
rṣya	𑂨	ṣtra	𑂨
		ṣtva	𑂩 𑂪
lkya	𑂫	ṣtha	𑂫 𑂬

Figure 43: Distinctive features of Nandinagari (from Grünendahl 2001: 208).

NANDINAGARI			
ṣṇa	ṣṇ		
ṣṇu	ṣṇᵃ		
ṣṇva	ṣṇᵃ		
ṣma	ṣᵃ	ṣᵃ	
ṣya	ṣᵃ		
ṣva	ṣᵃ		
ska	ṣᵃ	ṣᵃ	
sta	ṣᵃ	ṣᵃ	
stra	ṣᵃ	ṣᵃ	
stha	ṣᵃ	ṣᵃ	ṣᵃ
sma	ṣᵃ	ṣᵃ	
sya	ṣᵃ	ṣᵃ	
sra	ṣᵃ	ṣᵃ	
sva	ṣᵃ	ṣᵃ	
hna	ṣᵃ		
hma	ṣᵃ		
hya	ṣᵃ		
hla	ṣᵃ		
hva	ṣᵃ		

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Figure 44: Distinctive features of Nandinagari (from Grünendahl 2001: 209).

<u>Vowels</u>				
अ a(अ)	आ ā(आ)	इ i(इ)	ई ī(ई)	
उ u(उ)	ऊ ū(ऊ)	ऋ ṛ(ऋ)	ॠ ṝ(ॠ)	
ए e(ए)	ऐ ai(ऐ)	ओ o(ओ)	औ au(औ)	
<u>Consonants</u>				
क k(क)	ख kh(ख)	ग g(ग)	घ gh(घ)	ङ ṅ(ङ)
च c(च)	छ ch(छ)	ज j(ज)	झ jh(झ)	ञ ñ(ञ)
ट ṭ(ट)	ठ ṭh(ठ)	ड ḍ(ड)	ढ ḍh(ढ)	ण ṇ(ण)
त t(त)	थ th(थ)	द d(द)	ध dh(ध)	न n(न)
प p(प)	फ ph(फ)	ब b(ब)	भ bh(भ)	म m(म)
य y(य)	र r(र)	ल l(ल)	व v(व)	
श ś(श)	ष ṣ(ष)	स s(स)	ह h(ह)	

Figure 45: A chart showing letters of Nandinagari (from Mukhopadhyaya 2005).

**ISO/IEC JTC 1/SC 2/WG 2
PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS
FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646¹**

Please fill all the sections A, B and C below.

Please read Principles and Procedures Document (P & P) from <http://std.dkuug.dk/JTC1/SC2/WG2/docs/principles.html> for guidelines and details before filling this form.

Please ensure you are using the latest Form from <http://std.dkuug.dk/JTC1/SC2/WG2/docs/summaryform.html>.

See also <http://std.dkuug.dk/JTC1/SC2/WG2/docs/roadmaps.html> for latest **Roadmaps**.

A. Administrative

1. **Title:** *Final proposal to encode Nandinagari in Unicode*

2. Requester's name: *Anshuman Pandey <pandey@umich.edu>*

3. Requester type (Member body/Liaison/Individual contribution): *Expert contribution*

4. Submission date: *2017-05-05*

5. Requester's reference (if applicable): _____

6. Choose one of the following:

This is a complete proposal: Yes

(or) More information will be provided later:

B. Technical – General

1. Choose one of the following:

a. This proposal is for a new script (set of characters): Yes
Proposed name of script: *Nandinagari*

b. The proposal is for addition of character(s) to an existing block:
Name of the existing block: _____

2. Number of characters in proposal: *64*

3. Proposed category (select one from below - see section 2.2 of P&P document):

A-Contemporary	<input type="checkbox"/>	B.1-Specialized (small collection)	<input type="checkbox"/>	B.2-Specialized (large collection)	<input type="checkbox"/>
C-Major extinct	<input checked="" type="checkbox"/>	D-Attested extinct	<input type="checkbox"/>	E-Minor extinct	<input type="checkbox"/>
F-Archaic Hieroglyphic or Ideographic	<input type="checkbox"/>	G-Obscure or questionable usage symbols	<input type="checkbox"/>		

4. Is a repertoire including character names provided? Yes

a. If YES, are the names in accordance with the “character naming guidelines” in Annex L of P&P document? Yes

b. Are the character shapes attached in a legible form suitable for review? Yes

5. Fonts related:

a. Who will provide the appropriate computerized font to the Project Editor of 10646 for publishing the standard?
Anshuman Pandey

b. Identify the party granting a license for use of the font by the editors (include address, e-mail, ftp-site, etc.):
Anshuman Pandey

6. References:

a. Are references (to other character sets, dictionaries, descriptive texts etc.) provided? Yes

b. Are published examples of use (such as samples from newspapers, magazines, or other sources) of proposed characters attached? Yes

7. Special encoding issues:
Does the proposal address other aspects of character data processing (if applicable) such as input, presentation, sorting, searching, indexing, transliteration etc. (if yes please enclose information)? Yes

8. Additional Information:

Submitters are invited to provide any additional information about Properties of the proposed Character(s) or Script that will assist in correct understanding of and correct linguistic processing of the proposed character(s) or script. Examples of such properties are: Casing information, Numeric information, Currency information, Display behaviour information such as line breaks, widths etc., Combining behaviour, Spacing behaviour, Directional behaviour, Default Collation behaviour, relevance in Mark Up contexts, Compatibility equivalence and other Unicode normalization related information. See the Unicode standard at <http://www.unicode.org> for such information on other scripts. Also see Unicode Character Database (<http://www.unicode.org/reports/tr44/>) and associated Unicode Technical Reports for information needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard.

¹ Form number: N4502-F (Original 1994-10-14; Revised 1995-01, 1995-04, 1996-04, 1996-08, 1999-03, 2001-05, 2001-09, 2003-11, 2005-01, 2005-09, 2005-10, 2007-03, 2008-05, 2009-11, 2011-03, 2012-01)

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before?	Yes
If YES explain	<i>L2/13-002, L2/16-002, L2/16-310</i>
2. Has contact been made to members of the user community (for example: National Body, user groups of the script or characters, other experts, etc.)?	Yes
If YES, with whom?	<i>Jean-Luc Chevillard <jean-luc.chevillard@univ-paris-diderot.fr> Srinidhi A. <srinidhi.pinkpetals24@gmail.com></i>
If YES, available relevant documents:	
3. Information on the user community for the proposed characters (for example: size, demographics, information technology use, or publishing use) is included?	Yes
Reference:	<i>See section 2 of proposal</i>
4. The context of use for the proposed characters (type of use; common or rare)	<i>Common</i>
Reference:	<i>See section 2 of proposal</i>
5. Are the proposed characters in current use by the user community?	Yes;
If YES, where? Reference:	<i>Currently used by scholars of India; see section 2 of proposal</i>
6. After giving due considerations to the principles in the P&P document must the proposed characters be entirely in the BMP?	N/A
If YES, is a rationale provided?	
If YES, reference:	
7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)?	Yes
8. Can any of the proposed characters be considered a presentation form of an existing character or character sequence?	No
If YES, is a rationale for its inclusion provided?	
If YES, reference:	
9. Can any of the proposed characters be encoded using a composed character sequence of either existing characters or other proposed characters?	No
If YES, is a rationale for its inclusion provided?	
If YES, reference:	
10. Can any of the proposed character(s) be considered to be similar (in appearance or function) to, or could be confused with, an existing character?	No
If YES, is a rationale for its inclusion provided?	
If YES, reference:	
11. Does the proposal include use of combining characters and/or use of composite sequences?	Yes
If YES, is a rationale for such use provided?	Yes
If YES, reference:	<i>Combining signs</i>
Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided?	N/A
If YES, reference:	
12. Does the proposal contain characters with any special properties such as control function or similar semantics?	Yes
If YES, describe in detail (include attachment if necessary)	<i>Virama</i>
13. Does the proposal contain any Ideographic compatibility characters?	No
If YES, are the equivalent corresponding unified ideographic characters identified?	
If YES, reference:	