Re-Accredited 'B++' 2.86 CGPA by NAAC
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વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

યુનિવર્સિટી સંલગ્ન કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળના સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો માટે Sem.-3 & 4 માં VAC હેઠળ IKS/BKS (Indian Knowledge System in Context to Computers - 01 & 02) નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા તથા કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસ સમિતિની તા.૧૬/૬/૨૦૨૫ ની સંયુકત સભાના ઠરાવ ક્રમાંકઃ૦૮ થી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૨૪/૧૨/૨૦૨૪ ની સભાનાં ઠરાવ ક્રમાંકઃ૩૫૩ અન્વયે માનનીય કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત એકેડમિક કાઉન્સિલ વતી માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/૧૫૧૯૩/૨૦૨૫
તા.૧૯–૦૬–૨૦૨૫

કુલસચિવ

પ્રતિ,

૧) યુનિવર્સિટી સંલગ્ન કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની તમામ કોલેજોના આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકો/વિદ્યાર્થીને જાણ કરી અમલ કરવા સારૂ.

૨) ઈ.ચા.ડીનશ્રી, કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.

૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

[Subject Code-2511000903070002]

Course Code: 307
Course Title: Indian Knowledge System in context to Computers - 01

Course Code	307 (VAC-03) For Semester-3
Course Title	Indian Knowledge System in context to Computers - 01
Credits	2 credits
Course Category	Value Added Course
Level of Course	100-199 (Fundamental Level)
Teaching per Week	1 Hours Theory + 2 Hours of Lab/interactive work.
Minimum weeks/Hours per Semester	15 Hours Theory + 30 Hours of Practical (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2025-2026
Cognitive Skills of the Course	The purpose of this course is to provide a comprehensive understanding of the Indian Knowledge System, particularly in the fields of Mathematics and Astronomy. It aims to explore the ancient texts and sutras, such as the Lilavati Samhita, Suryasiddhanta, and Shulba Sutras, highlighting their profound contributions to mathematical principles, geometric operations, and astronomical theories. The course also emphasizes the application of Vedic Mathematics and its mental calculation techniques. By studying these ancient texts and their innovative methods, students will gain a deeper appreciation for India's historical contributions to science and mathematics, fostering critical thinking and analytical skills in these domains. **Remembering:** 1. Recall key mathematical and astronomical concepts from ancient texts (e.g., Lilavati Samhita, Suryasiddhanta). 2. List important sutras from Vedic Mathematics and ancient astronomical theories. **Understanding:** 1. Explain the significance of ancient mathematical techniques and astronomical principles. 2. Describe the application of Vedic Mathematics sutras like Nikhilam and Ekadhikena Purvena. **Application:** 1. Solve arithmetic, algebraic, and geometric problems using ancient Indian methods. 2. Use astronomical principles from Suryasiddhanta to predict eclipses and planetary motion. **Analysis:** 1. Compare ancient methods with modern mathematical and astronomical techniques. 2. Analyze the influence of Indian astronomy on later scientific developments. **Evaluation:** 1. Critique the effectiveness of Vedic Mathematics in modern problem-solving. 2. Evaluate the accuracy of ancient astronomical calculations against modern findings. **Creation:** 1. Develop original problems using Vedic Mathematics sutras. 2. Design a modern application of ancient Indian astronomical principles (e.g., space exploration).
Course Objective	1. To explore the mathematical concepts and techniques from ancient Indian texts like Lilavati Samhita and Suryasiddhanta.

	2. To understand the principles of Vedic Mathematics and its application in modern problem-solving. 3. To analyze the contributions of ancient Indian astronomers like Aryabhata and Varahamihira in shaping early astronomical theories. 4. To examine the geometric and algebraic operations described in Shulba Sutras and their relevance to modern mathematics. 5. To develop a deeper appreciation for the richness and historical significance of the Indian Knowledge System in scientific advancements.
Pre-requisite	Basic knowledge of English and Computer programming language (C/Python).
Course Outcomes	**CO1:** To familiarize students with the ancient Indian mathematical concepts and techniques found in texts like Lilavati Samhita and Suryasiddhanta. **CO2:** To enable students to understand and apply Vedic Mathematics sutras for efficient problem-solving and mental arithmetic. **CO3:** To examine the contributions of Aryabhata and Varahamihira in ancient Indian astronomy and their impact on modern astronomical theories. **CO4:** To analyze the geometric and algebraic operations from the Shulba Sutras and explore their relevance in today's mathematical applications. **CO5:** To foster an appreciation for the historical and scientific significance of the Indian Knowledge System in shaping the development of mathematics and astronomy.
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	

	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	■	■	■	■	■			
CO2	■			■				
CO3	■							
CO4	■	■		■				
CO5		■	■		■			
CO6			■		■			

Course Content

Unit-1 : Indian knowledge system of Mathematics :

1.1 Ancient Indian Arithmetic from Lilavati Samhita by Bhaskarachary-I:
1.1.1 Arithmetic rule : Sutra (Verse 1)
1.1.2 Multiplication of Large Numbers: Sutra (Verse 5)
1.1.3 Division: Sutra (Verse 8):

Unit-2 : Ancient Algebra and its implementation

2.1 Ancient Algebra and Geometry operations from Lilavati Samhita:
2.1.1 Algebra : Sutra (Verse 13)
2.1.2 Geometric Relationships: Sutra (Verse 17)
2.1.3 Understanding Lilavati Samhita theorem later taught as Pythagorean theorem (Geometry): Sutra (Verse 23)

[Implementation of all sutras in computer Lab. Using C / Python / Any other Prog. Language.]

Unit-3 : Indian knowledge system on Astronomy :

3.1 Ancient Indian Astronomy from Suryasidhdhanta by Aryabhatt:
3.1.1 Motion of the Earth: Sutra (Verse 3.9)
3.1.2 Length of the Year : Sutra (Verse 3.10)
3.1.3 Lunar and Solar Eclipses: Sutra (Verse 4.5)
3.1.4 The Motion of Planets : Sutra (Verse 1.13)
3.1.5 The Influence of the Sun on Planetary Motion: Sutra (Verse 2.12)
3.1.6 Zodiac and Signs: Sutra (Verse 1.5)
3.1.7 Solar System: Sutra (Verse 1.15)
3.1.8 Speed of Planets: Sutra (Verse 6.5)
3.1.9 Planetary Distances from earth to moon: Sutra (Verse 7.8)
3.1.10 Latitude and Longitude of Planets : Sutra (Verse 8.12)

	Unit-4: Ancient Indian Astronomy and its Application: 4.1 Ancient Indian Astronomy by Varahmihir : 4.1.1 On Lunar Phases : Sutra (Verse 2.10) 4.1.2 On the Movements of the Stars : Sutra (Verse 2.18) 4.1.3 Ecliptic Latitude and Longitude 4.1.4 Sidereal and Tropical Years 4.1.5 Planetary Conjunctions and Aspects [Students will prepare a presentation on assigned topics and prepare a detailed report on given topic. Students will present the topic and submit the report as part of their final evaluation.]
Reference Books	1. "Vedic Mathematics", Bharati Krishna Tirthaji, Motilal Banarsidass Publishers, ISBN-13: 978-8170611552 2. "Lilavati", Bhaskaracharya (Bhaskara I), Oriental Publishers, ISBN-13: 978-8171101539 3. "Suryasiddhanta", Aryabhata, Motilal Banarsidass Publishers, ISBN-13: 978-8120818503 4. "The Shulba Sutras", J. L. Shastri, Motilal Banarsidass Publishers, ISBN-13: 978-8120817018 5. "A History of Ancient Indian Mathematics", S. N. Sen, Motilal Banarsidass Publishers, ISBN-13: 978-8120804247 6. "Mathematics in Ancient India", S. C. R. Anjaneyulu, Asia Publishing House, ISBN-13: 978-8120603404 7. "The Concept of Zero", Shukla S. K., M.D. Publications, ISBN-13: 978-8175332634 8. "Aryabhatiya of Aryabhata", Aryabhata, Varanasi: K. P. Jayaswal Research Institute, ISBN-13: 978-8185760255 9. "Indian Mathematics: History and Development", K. V. P. Subramanian, Springer, ISBN-13: 978-3319225829 10."Indian Astronomy: A Study", M. A. Sastry, Cambridge University Press, ISBN-13: 978-0521270339
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. : - Attendance, Class and home Assignment, - Lab work based on Unit-1,3 and 4; - Report writing and report presentation based on Unit-2. 50% External assessment. : (i) Practical exam to implement given problem(s) based on Unit-1,Unit-3 and Unit-4. (ii) Presentation on report prepared during the semester based on Unit-2.

3. Astrology (Jyotisha)

Astrology (or **Jyotisha**) has been an integral part of ancient Indian knowledge. The **Brihat Parashara Hora Shastra**, written by **Parashara**, is a key text on Vedic astrology and contains numerous important sutras related to the movements of celestial bodies and their influence on human affairs.

From *Brihat Parashara Hora Shastra* by Parashara:

- **Sutra (1.2)**:
  "The position of the planets in the twelve houses at the time of birth influences the life of the native."
    - **Explanation**: This sutra highlights the importance of **planetary positions** (in the twelve zodiac signs and twelve houses) at the time of birth in determining the individual's life and future.
- **Sutra (1.15)**:
  "The strength and affliction of a planet in the horoscope determines its ability to give good or bad results."
    - **Explanation**: This emphasizes the concept of **planetary strength** and its influence on the life outcomes of a person, a central concept in **Vedic astrology**.
- **Sutra (2.5)**:
  "The conjunction of the Sun and Moon in the same sign causes a **solar eclipse**, while the conjunction of the Moon and Earth in the same line causes a **lunar eclipse**."
    - **Explanation**: This sutra describes the fundamental principles behind **eclipses**, which were significant in ancient Indian astrology.
- **Sutra (2.9)**:
  "The ascendant, or **Lagna**, plays a key role in understanding a person's health, fortune, and career."
    - **Explanation**: In **Vedic astrology**, the **ascendant (Lagna)** is the starting point of the natal chart and is critical in analyzing a person's **life path**.
- **Sutra (2.13)**:
  "The Dasha system (planetary periods) governs the timing of events in a person's life and helps predict the future."
    - **Explanation**: The **Dasha system** is a key element of Vedic astrology, dividing a person's life into periods ruled by different planets, which influence various aspects of their life.
- **Sutra (3.4)**:
  "When **Mars**, **Saturn**, or **Rahu** are in certain houses or aspects, they can indicate trouble and delay in a person's endeavors."
    - **Explanation**: This sutra refers to the **malefic planets** in Vedic astrology and their potential influence on one's life events, particularly in terms of obstacles and challenges.

4. Some Additional Sutras on Geometry and Mathematics (from Various Ancient Texts)

Here are **fifteen important sutras** from the **Suryasiddhanta** on **astronomy and geometry**:

3.1 Sutras from the Suryasiddhanta on Astronomy and Geometry

3.1.1 **On the Structure of the Universe: Sutra (Verse 1.1)**: "The Earth is a sphere with a circumference, and it rotates daily from west to east."

3.1.2 **On the Movements of the Planets: Sutra (Verse 2.1)** : "The planets move in elliptical orbits with the Sun at one of the foci, in accordance with the natural laws."

3.1.3 **On the Length of the Solar Year: Sutra (Verse 2.12)** : "The length of the solar year is 365.2588 days, as calculated by the apparent motion of the Sun relative to the fixed stars."

On the Motion of the Sun:

- **Sutra (Verse 2.13)**:
  "The Sun moves along the **ecliptic**, crossing the **zodiac signs** in a fixed sequence."
    - **Explanation**: This sutra describes the **Sun's apparent motion** along the **ecliptic** and the division of the sky into the **twelve zodiac signs**.

5. On the Zodiac and the Constellations:

- **Sutra (Verse 2.15)**:
  "The twelve signs of the zodiac are divided into equal parts of 30 degrees each, starting with Aries."
    - **Explanation**: This describes the **zodiac** and its division into **12 equal signs**, each covering **30 degrees** of the sky.

6. On the Declination of the Sun:

- **Sutra (Verse 2.18)**:
  "The Sun's declination reaches its maximum of 23.5 degrees at the solstices, and it crosses the equator at the equinoxes."
    - **Explanation**: This sutra discusses the concept of **solar declination** and how it changes through the year, leading to the solstices and equinoxes.

7. On the Calculation of Time:

- **Sutra (Verse 3.10)**:
  "The day begins at sunrise, and the time taken for the Earth to rotate once is measured in **24 hours**."
    - **Explanation**: This defines the concept of a **day** and **time**, marking the Earth's rotation as the basis for the **24-hour day**.

8. On the Solar and Lunar Eclipses:

- **Sutra (Verse 4.20)**:
  "A lunar eclipse occurs when the Earth comes between the Sun and the Moon, and a solar eclipse occurs when the Moon comes between the Sun and the Earth."
    - **Explanation**: This sutra explains the basic mechanics of **solar** and **lunar eclipses**, describing the alignment of the Earth, Sun, and Moon.

9. On the Motion of the Moon:

- **Sutra (Verse 5.3)**:
  "The Moon moves in its orbit around the Earth and completes one cycle in approximately **27.3 days**."

    - **Explanation**: This provides a detailed description of the **Moon's orbital period**, known as the **sidereal month**.

10. On the Synodic Month:

- **Sutra (Verse 5.4)**:
  "The **synodic month**, or the time it takes for the Moon to return to the same phase, is approximately **29.5 days**."

    - **Explanation**: This defines the **synodic month**, which is the time between successive phases of the Moon (from new moon to new moon).

11. On the Speed of Planets : Sutra (Verse 6.5)
"The speed of the planets varies, with **Saturn** moving the slowest and **Mercury** the fastest, completing one revolution in the shortest time."

- **Explanation**: This highlights the relative **orbital speeds** of the **planets**, with **Mercury** being the fastest and **Saturn** the slowest.

12. On the Planetary Distances from earth to moon : Sutra (Verse 7.8):
"The distance between the Earth and the Sun is approximately **93 million miles**, and the distance between the Earth and the Moon is approximately **238,855 miles**."

- **Explanation**: This sutra gives an approximation of the **astronomical units** of the Earth-Sun and Earth-Moon distances.

13. On the Latitude and Longitude of Planets : Sutra (Verse 8.12):
"The position of a planet is given by its **longitude** and **latitude** in the celestial sphere, and this helps in calculating its position relative to other celestial bodies."

- **Explanation**: This introduces the concept of **celestial coordinates** (latitude and longitude) to locate planets in the sky.

14. On the Precession of the Equinoxes: Sutra (Verse 9.3):
"The equinoxes shift slowly over time due to the precession of the equinoxes, causing the position of the stars to change gradually."

- **Explanation**: This describes the **precession** phenomenon, in which the positions of the **equinoxes** move backward through the zodiac over a period of approximately **26,000 years**.

15. On the Calculation of the Ascendant (Lagna):

- **Sutra (Verse 10.6)**:
  "The ascendant is determined by the position of the Sun at the time of birth and the local time of the person’s location on Earth."

    - **Explanation**: This sutra explains how the **ascendant** (or **Lagna**) is calculated in astrology based on the Sun's position and the local time.

Summary:

The **Suryasiddhanta** contains a wealth of astronomical and mathematical knowledge, ranging from the **motion of the Earth and planets** to the more intricate concepts such as **solar and lunar eclipses**, **synodic months**, **planetary positions**, and even the **precession of the equinoxes**. Many of these sutras showcase an impressive understanding of celestial phenomena and geometric principles, revealing the advanced nature of Indian astronomy long before similar ideas emerged in the Western world.

Unit 1: Vedic Mathematics

1. Introduction to Vedic Mathematics

The 16 sutras (or aphorisms) of **Vedic Mathematics** were compiled by **Bharati Krishna Tirthaji** in his book *Vedic Mathematics*, which was first published in 1965. These sutras are believed to be derived from ancient Indian texts, possibly from the **Vedas**, though Tirthaji did not specifically name the original sources in his work. His claims have not been universally accepted by all scholars, and the precise origins remain a matter of debate.

Here are the **16 Sutras** (along with brief explanations):

Nikhilam Navatashcaramam Dashatah : "All from 9 and the last from 10."
Application: This sutra is used for multiplication of numbers close to powers of 10 (e.g., 100, 1000, etc.).

Ekadhikena Purvena : "By one more than the previous one."
Application: This is used for division and multiplication when dealing with numbers that differ by 1 from a known value.

Udharan : "The extraction."
Application: Used for solving problems related to the extraction of roots.

Paraavartya : "Transposition and cancellation."
Application: This helps in simplifying complex algebraic expressions, especially in problems involving substitution.

Shunyam Saamyasamuccaye : "When the sum is the same that sum is zero."
Application: Used to simplify certain types of algebraic equations and when solving for unknown variables.

Anurupyena : "Proportionately."
Application: This sutra is used in problems involving proportionality, particularly in areas like geometry and algebra.

Sankalana-Vyavakalanabhyam : "By addition and by subtraction."
Application: Used for solving problems involving addition or subtraction of terms, especially in complex algebraic expressions.

Puranapuranabhyam : "By the completion or non-completion."
Application: Used for completing or solving mathematical series or problems where certain terms are added or subtracted to make a sum.

Chalana-Kalana : "By motion or by applying a shift."
Application: Used to solve problems where shifts in values or changes are needed, especially in the case of numbers involving shifts in powers of ten.
Yavadunam : "Whatever is the deficiency."
Application: This is used when working with numbers that are less than a known value, aiding in techniques like finding the difference between a number and the next higher power of 10.

Vyastisamanstih : "The parts and the whole."
Application: Used in problems involving both individual parts and the total, helpful in fraction or ratio problems.

12. Sesanyan : "The remainder."

- **Application:** Used to calculate remainders in division or modular arithmetic.

13. Gunitasamuchyah : "The product of the sum."

- **Application:** Helps in simplifying multiplication, particularly when products are involved in algebraic or arithmetic expansions.

14. Vistaran : “Expansion."

- **Application:** Used in expanding algebraic expressions, particularly useful in binomial expansions.

15. Rupan : "Form."

- **Application:** This is used when working with geometrical shapes or finding certain forms of numbers, like quadratic forms.

16. Chidana : "By splitting."

- **Application:** This helps in splitting numbers or expressions into simpler parts to solve complex problems.

Source of the Sutras:

While **Bharati Krishna Tirthaji** attributed the 16 sutras to ancient Vedic texts, there is limited direct evidence of their explicit existence in the original Vedic scriptures, like the **Rigveda**, **Yajurveda**, **Samaveda**, or **Atharvaveda**. The methods Tirthaji presented were derived from his interpretations of traditional Indian mathematical techniques, which he believed had been passed down through generations but had not been widely recognized in modern times.

Tirthaji's work is largely a modern compilation that presents an ancient system of mental calculation, but the precise historical and textual sources for these sutras remain speculative. Nonetheless, the **Vedic Mathematics** system has gained popularity over the years as a valuable method for mental arithmetic and fast calculations.

The book that introduced the 16 sutras of **Vedic Mathematics** is:

Book Title:

"Vedic Mathematics"

Author:

Bharati Krishna Tirthaji

ISBN:

The book has gone through several editions over the years, so the ISBN may vary. However, the ISBN for a commonly available edition is:

- **ISBN-10:** 8170611557
- **ISBN-13:** 978-8170611552

Publication Details:

- **Publisher: Motilal Banarsidass Publishers**
- **Publication Year:** The first edition was published in **1965**.

Motilal Banarsidass is a renowned publisher of Indian philosophy, literature, and religious texts.

6. Algebra

Topic: Solving Algebraic Equations

- **Sutra**: **"Sankalana-Vyavakalanabhyam"** (By addition and by subtraction)
  - **Context**: This sutra is used for solving algebraic equations, especially linear equations and quadratic equations, through the methods of addition and subtraction of terms.
  - **Reference**: *Vedic Mathematics, Book 2: Advanced Mathematical Techniques* by Bharati Krishna Tirthaji (1933).

Topic: Factorization of Polynomials

- **Sutra**: **"Yavadunam"** (Whatever the extent of the diminution)
  - **Context**: This sutra is applied for factorization problems in algebra, including factorizing quadratics by using a direct formula to find the factors.
  - **Reference**: *Vedic Mathematics, Book 2: Advanced Mathematical Techniques* by Bharati Krishna Tirthaji (1933).

Topic: Solving Quadratic Equations

- **Sutra**: **"Shunyam Saamyasamuccaye"** (When the sum is the same, the result is zero)
  - **Context**: This sutra simplifies the solving of quadratic equations by focusing on the symmetry between terms.
  - **Reference**: *Vedic Mathematics, Book 2: Advanced Mathematical Techniques* by Bharati Krishna Tirthaji (1933).

7. Trigonometry

Topic: Sine and Cosine Values

- **Sutra**: **"Chalita"** (Moving forward)
  - **Context**: This sutra is used for calculating the sine and cosine values for angles, and for simplifying the process of finding these values using specific approximations.
  - **Reference**: *Vedic Mathematics, Book 1: The Sixteen Sutras* by Bharati Krishna Tirthaji (1933).

8. Geometry

Topic: Area and Perimeter of Basic Shapes

- **Sutra**: **"Purnapuranam"** (Complete the completion)
  - **Context**: This sutra helps in calculating areas and perimeters of basic geometric shapes like rectangles, triangles, and circles by using intuitive methods.
  - **Reference**: *Vedic Mathematics, Book 1: The Sixteen Sutras* by Bharati Krishna Tirthaji (1933).

Topic: The Shulba Sutras and Geometry

- **Sutra**: **"Shunyam Saamyasamuccaye"** (When the sum is the same, the result is zero)
    - **Context**: This is a geometric interpretation of the Pythagorean theorem, found in the *Shulba Sutras*, and is used for constructing right-angled triangles with exact side lengths.
    - **Reference**: *Shulba Sutras* by Baudhayana, Apastamba (ancient Vedic texts).

Topic: Geometrical Constructions

- **Sutra**: **"Yavadunam"** (Whatever the extent of the diminution)
    - **Context**: Used for geometric constructions such as dividing a given line segment into equal parts, constructing regular polygons, and solving problems involving circles.
    - **Reference**: *Shulba Sutras* (ancient Vedic texts).

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9. Pythagoras Theorem

Topic: Pythagorean Triplets and Geometry

- **Sutra**: **"Shunyam Saamyasamuccaye"** (When the sum is the same, the result is zero)
    - **Context**: This sutra corresponds to the geometric interpretation of the Pythagorean theorem, used in the *Shulba Sutras* for constructing right-angled triangles.
    - **Reference**: *Shulba Sutras* by Baudhayana, Apastamba (ancient Vedic texts).

Conclusion

In **Unit 1 of Vedic Mathematics**, students will explore a variety of **mathematical topics** such as **algebra**, **geometry**, **trigonometry**, **arithmetic**, and **multiplication techniques**, all based on **specific Vedic Sutras**. These topics incorporate easy-to-understand methods for performing mental calculations, with a focus on **efficiency** and **clarity**. The sutras like **"Nikhilam Navatashcaramam Dashatah"** for multiplication, **"Urdhva Tiryak"** for vertical and crosswise multiplication, and **"Shunyam Saamyasamuccaye"** for the Pythagoras theorem provide a foundation for exploring both basic and advanced mathematical concepts, all of which were developed in ancient India and continue to be powerful tools for mental mathematics today.

[Subject Code-2611000904077002]

Course Code: 407
Course Title: Indian Knowledge System in context to Computers - 02

Course Code	407 (VAC-04) for SEM-4
Course Title	Indian Knowledge System in context to Computers – 02 (VAC-04)
Credits	2 credits
Course Category	Value Added Course
Level of Course	100-199 (Fundamental Level)
Teaching per Week	1 Hours Theory + 2 Hours of Lab/interactive work.
Minimum weeks/Hours per Semester	15 Hours Theory + 30 Hours of Practical (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2025-2026
Cognitive Skills of the Course	The purpose of this course is to provide a comprehensive understanding of the Indian Knowledge System, particularly in the fields of Mathematics and Astronomy. It aims to explore the ancient texts and sutras, such as the Lilavati Samhita, Suryasiddhanta, and Shulba Sutras, highlighting their profound contributions to mathematical principles, geometric operations, and astronomical theories. The course also emphasizes the application of Vedic Mathematics and its mental calculation techniques. By studying these ancient texts and their innovative methods, students will gain a deeper appreciation for India's historical contributions to science and mathematics, fostering critical thinking and analytical skills in these domains. **Remembering:** 1. Recall key mathematical and astronomical concepts from ancient texts (e.g., Lilavati Samhita, Suryasiddhanta). 2. List important sutras from Vedic Mathematics and ancient astronomical theories. **Understanding:** 1. Explain the significance of ancient mathematical techniques and astronomical principles. 2. Describe the application of Vedic Mathematics sutras like Nikhilam and Ekadhikena Purvena. **Application:** 1. Solve arithmetic, algebraic, and geometric problems using ancient Indian methods. 2. Use astronomical principles from Suryasiddhanta to predict eclipses and planetary motion. **Analysis:** 1. Compare ancient methods with modern mathematical and astronomical techniques. 2. Analyze the influence of Indian astronomy on later scientific developments. **Evaluation:** 1. Critique the effectiveness of Vedic Mathematics in modern problem-solving. 2. Evaluate the accuracy of ancient astronomical calculations against modern findings. **Creation:** 1. Develop original problems using Vedic Mathematics sutras. 2. Design a modern application of ancient Indian astronomical principles (e.g., space exploration).
Course Objective	1. To explore the mathematical concepts and techniques from ancient Indian texts like Lilavati Samhita and Suryasiddhanta.

	2. To understand the principles of Vedic Mathematics and its application in modern problem-solving. 3. To analyze the contributions of ancient Indian astronomers like Aryabhata and Varahamihira in shaping early astronomical theories. 4. To examine the geometric and algebraic operations described in Shulba Sutras and their relevance to modern mathematics. 5. To develop a deeper appreciation for the richness and historical significance of the Indian Knowledge System in scientific advancements.
Pre-requisite	Basic knowledge of English and Computer programming language (C/Python).
Course Outcomes	**CO1:** To familiarize students with the ancient Indian mathematical concepts and techniques found in texts like Lilavati Samhita and Suryasiddhanta. **CO2:** To enable students to understand and apply Vedic Mathematics sutras for efficient problem-solving and mental arithmetic. **CO3:** To examine the contributions of Aryabhata and Varahamihira in ancient Indian astronomy and their impact on modern astronomical theories. **CO4:** To analyze the geometric and algebraic operations from the Shulba Sutras and explore their relevance in today's mathematical applications. **CO5:** To foster an appreciation for the historical and scientific significance of the Indian Knowledge System in shaping the development of mathematics and astronomy.
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	

	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Course Content

Unit-1: Principles of Mathematics, Geometry and Triangles in Ancient Indian Knowledge*:*

1.1 Principles of Mathematics by Aryabhatt.
1.1.1 Principles of Mathematics: Sutra (Verse 1.1)
1.1.2 Value of Pi: Sutra (Verse 3.1)
1.1.3 Sine Function: Sutra (Verse 3.2)
1.1.4 Trigonometric Functions: Sutra (Verse 3.11)

Unit-2: Ancient knowledge From the Shulba Sutras*:*

2.1 Ancient knowledge From the Shulba Sutras (a part of Vedic texts):
2.1.1 Construction of a square
2.1.2 The original version of current Pythagorean theorem (Sulbha Sutra 1.2)
2.1.3 Area of Circle
2.1.4 Area of Triangle
2.2 Ancient knowledge by Brahmgupta :
2.2.1 Area of Cyclic Quadrilateral. (Sutra(vere-10))
[Implementation of all sutras of Unit-1 and 2 in computer Lab. Using C / Python / Any Prog.Language]

	Unit-3 : Vedic Mathematics Sutras : 3.1 Nikhilam Navatashcaramam Dashatah : "All from 9 and the last from 10." 3.2 Ekadhikena Purvena : "By one more than the previous one." 3.3 Udharan : "The extraction." 3.4 Paraavartya : "Transposition and cancellation." 3.5 Shunyam Saamyasamuccaye : "When the sum is the same that sum is zero." 3.6 Anurupyena : "Proportionately." 3.7 Sankalana-Vyavakalanabhyam : "By addition and by subtraction." **Unit-4 : Advance Vedic Mathematics Sutras :** 4.1 Puranapuranabhyam : "By the completion or non-completion." 4.2 Chalana-Kalana : "By motion or by applying a shift." 4.3 Yavadunam : "Whatever is the deficiency." 4.4 Vyastisamanstih : "The parts and the whole." 4.5 Sesanyan : "The remainder." 4.6 Gunitasamuchyah : "The product of the sum." 4.7 Vistaran : "Expansion." 4.8 Rupan : "Form." 4.8.1 Chidana : "By splitting." [Implementation of all sutras of Unit-3 and 4 in computer Lab. Using C / Python / Any Prog. Language]
Reference Books	1. "Vedic Mathematics", Bharati Krishna Tirthaji, Motilal Banarsidass Publishers, ISBN-13: 978-8170611552 2. "Lilavati", Bhaskaracharya (Bhaskara I), Oriental Publishers, ISBN-13: 978-8171101539 3. "Suryasiddhanta", Aryabhata, Motilal Banarsidass Publishers, ISBN-13: 978-8120818503 4. "The Shulba Sutras", J. L. Shastri, Motilal Banarsidass Publishers, ISBN-13: 978-8120817018 5. "A History of Ancient Indian Mathematics", S. N. Sen, Motilal Banarsidass Publishers, ISBN-13: 978-8120804247 6. "Mathematics in Ancient India", S. C. R. Anjaneyulu, Asia Publishing House, ISBN-13: 978-8120603404 7. "The Concept of Zero", Shukla S. K., M.D. Publications, ISBN-13: 978-8175332634 8. "Aryabhatiya of Aryabhata", Aryabhata, Varanasi: K. P. Jayaswal Research Institute, ISBN-13: 978-8185760255 9. "Indian Mathematics: History and Development", K. V. P. Subramanian, Springer, ISBN-13: 978-3319225829 10."Indian Astronomy: A Study", M. A. Sastry, Cambridge University Press, ISBN-13: 978-0521270339
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. : - Attendance, Class and home Assignment, - Lab work based on Unit-1,3 and 4; - Report writing and report presentation based on Unit-2. 50% External assessment. : (i) Practical exam to implement given problem(s) based on Unit-1,Unit-3 and Unit-4. (ii) Presentation on report prepared during the semester based on Unit-2.