

FYUGP Syllabus, Department of Mathematics, Dibrugarh University

Content of the existing syllabus of FYUGP that has been identified and aligning with Ancient Indian Mathematics as a part of Indian Knowledge System

| Paper | Content | Reference | Contant hours | Credit |
|--|--|--|---------------|------------|
| FYUGP 1st Semester | | | | |
| Calculus and Classical Algebra MTHC1 | Unit I: Trigonometry in Classical India: Sine table, value of $\sin(x + \epsilon)$ and approximate to first and second derivative of $\sin x$. Derivation of Rsine, first and second order differences for Rsines. Unit V: A brief history of Bhaskaracharya. The Six rules for positive and negative numbers, The Six rules for Zero, The Six rules for algebraic numbers, Equation of the form $Ax+c=by$, Equation with one unknown. The ten questions. | 1. Was Calculus Invented in India? D Bressoud, he College Mathematics Journal, Vol. 33, No. 1 (Jan., 2002), pp. 2-13 2. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram (Published by Hindustan Book Agency, 2008). 3. Hindu Mathematics, B Datta, A. N. Singh, Asia Public House, New Delhi. | 09 | 0.6 |
| Differential Calculus MINMTH-1 | Dividing the circumference into arc-bits: Approximating the arc-bits by Jyardha-s (Rsines); Circumference in terms of the Karna-s; Calculation of the circumference; Conversion of the Rsine to arc; Construction of Sine tables, The power series expansion for sine. | 1. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram, Hindustan Book Agency, 2008. 2. Kartz Victor J., A History of Mathematics: An Introduction, Pearson, 2009. 3. Was Calculus Invented in India? D Bressoud, he College Mathematics Journal, | 09 | 0.6 |

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| | | Vol. 33, No. 1 (Jan., 2002), pp. 2-13 | | |
| Foundation in Mathematics-I GECMTH1A | <p>Unit I: Philosophical foundation of set theory in Indian logic.</p> <p>Unit II: Nyāya and Vaiśeṣika Systems, Discussion of sambandha (relation) - samavāya (inherence), saṃyoga (contact), and samaveta-samavāya .</p> <p>Unit III: Historical Foundations of Calculus in India, Explanations involving infinitesimal increments and convergence in Yuktibhasa, Siddhānta Shiromani by Bhāskara II, Mādhava's Series for π, $\sin(x)$, $\cos(x)$, and $\arctan(x)$.</p> <p>Unit IV: Bhāskara's treatment of changing quantities; Concept of Tatkālika Gati, Madhava's iterative corrections in trigonometric series.</p> | <p>1. K. V. Sarma, A History of the Kerala School of Hindu Astronomy, Vishveshvarananda Institute of Sanskrit and Indological Studies, Panjab University, Hoshiarpur</p> <p>2. B.K. Matilal, Navya–Nyaya Doctrine of Negation – Semantics & Ontology of Negative Statements: The Semantics and Ontology of Negative Statements in Navya-Nyaya Philosophy (Harvard Oriental Series) Harvard University Press, 1990.</p> | 18 | 1.2* |
| History of Mathematics GECMTH1B | <p>Unit I: A glimpse of ancient India; Hindus and mathematics; Scope and development of Hindu mathematics.</p> <p>Unit II: Numeral terminology; The development of Numerical Symbol; The decimal place-value system; Persistence of the old system; Word numerals; Alphabetic notations; The zero symbol; The place-value notation in Hindu literature.</p> <p>Unit III: Estimating the values of pi. Ramanujan's view on Magic square.</p> <p>Unit IV: Ancient and Medieval India: Arithmetic algorithms; Geometry; Linear congruence; Construction of Sine tables;</p> | <p>1. Datta B., Narayan Singh A., History of Hindu Mathematics (Part I), Gyan Publishing House, 2021.</p> <p>2. Kartz Victor J., A History of Mathematics: An Introduction, Pearson, 2009.</p> <p>3. Burton David M., The History of Mathematics: An Introduction, Mc Graw Hill, 2011.</p> <p>4. Berndt Bruce C., Ramanujan's Notebooks: Part I, Springer, 1985.</p> | 35 | 2.3* |

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| | Transmission to and from India. Diophantine Equations in India; Early Mathematics in India. Linear Equations in One and Two unknown. The Rule of three. | | | |
| VAC1 | Understanding India | | 30 | 2* |
| Total | | | 66 | 4.4 |
| FYUGP 2nd Semester | | | | |
| Real Analysis And Differential Equation MTHC2 | Summation of series: Sum of natural numbers; Summation of squares; Summation of third and fourth powers; General principle of summation; Repeated summations. Approximate to first and second derivative of $\sin x$. | 1."Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram (Published by Hindustan Book Agency, 2008). 2. Was Calculus Invented in India? D Bressoud, the College Mathematics Journal, Vol. 33, No. 1 (Jan., 2002), pp. 2-13. | 09 | 0.6 |
| Real analysis MINMTH2 | Unit I and III: From Zero to Infinity: Mathematics in Jain and Buddhist Literature; The Ten Questions and Answers; Arithmetics of Fractions; Progression (series), AP series, GP series | 1. Lilavati of Bhaskaracharya: Patwardhan, Nainpally, Singh. Motilal Banarassdass 2. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram (Published by Hindustan Book Agency, 2008). | 09 | 0.6 |
| Business Mathematics GECMTH2B | Fraction, commercial problem, simple interest, combination, progression. | 1. B. Datta, A. N. Singh, Hindu Mathematics. 2.Lilavati of Bhaskaracharya: Patwardhan, Nainpally, Singh. Motilal | 09 | 0.6* |

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| | | BanarassdassPublishers, Delhi, 2001 | | |
| VAC 2 | YOGA | | 30 | 2* |
| Total | | | 57 | 3.8 |
| FYUGP 3rd Semester | | | | |
| Theory of real functions MTHC3 | Unit 1: Historical Roots of the Concept of Limit in Ancient India, Bhāskara II's concept of infinitesimals, Vedāntic concept of the Ananta (Infinite) and Parimita (Finite). Unit II: Concept of Continuity in Ancient Indian Sciences and in Nyāya Philosophy. Unit III: Concept of infinitesimal increments and convergence in Yuktibhasa, Siddhānta Shiromani by Bhāskara II, Bhāskara's treatment of changing quantities; Concept of Tatkālika Gati. Unit IV: Taylor series for sine and cosine functions by Madhaba of Sangamagrama, Derivation of power series of sine and cosine by Madhaba. | 1. A History the of Kerella school of Hindu Astronomy, K. V. Sarma, Vishveshvaranand Institute, Hoshairpur, 1972. | 09 | 0.6 |
| Group Theory I MTHC4 | Unit I and II: Symmetry in Indian art, architecture, and geometry – examples from <i>Śrī Yantra</i> , <i>Kolam/Rangoli</i> patterns, and temple layouts (e.g., Konark, Khajuraho) illustrating rotational and reflectional symmetries. Concepts of transformation and structural preservation in the <i>Śulbasūtras</i> . Cyclic rhythmic patterns (<i>Tāla</i>) as analogues of abelian groups; sub-patterns in <i>Mandala</i> designs as subgroups; central <i>Bindu</i> in <i>Yantra</i> representing the group center and invariance. | 1. R. Prabakaran (2025)-Mathematics in Indian Knowledge System 2. Bibhutibhushan Datta-Ancient Indian Geometry: The Science of the Śulbasūtras. | 09 | 0.6 |
| Differential Equations MINMTH-3 | Concept of infinitesimal increments and convergence in Yuktibhasa, | 1. A History the of Kerella school of Hindu Astronomy, K. | 09 | 0.6 |

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| | SiddhāntaShiromani by Bhāskara II, Bhāskara's treatment of changing quantities; Concept of Tatkalika Gati. Approximate to first and second derivative of $\sin x$. | V. Sarma, Vishveshvaranand Institute, Hoshairpur, 1972. 2. Was Calculus Invented in India? D Bressoud, he College Mathematics Journal, Vol. 33, No. 1 (Jan., 2002), pp. 2-13 | | |
| Mathematical Finance GECMTH-3A | Fraction, commercial problem, simple interest, combination, progression. | 1.B. Datta, A. N. Singh, Hindu Mathematics, New Delhi. 2. Lilavati of Bhaskaracharya: Patwardhan, Nainpally, Singh. Motilal Banarassdass Publishers, Delhi, 2001. | 09 | 0.6* |
| Mathematical Logic SEC-315 | Philosophical foundation of set theory in Indian logic. Nyāya and Vaiśeṣika Systems, Discussion of sambandha (relation)-samavāya (inherence), saṃyoga (contact), and samaveta-samavāya. | 1. K. V. Sarma, A History of the Kerala School of Hindu Astronomy, Vishveshvarananda Institute of Sanskrit and indological Studies, Panjab University, Hoshiarpur 2. B.K. Matilal, Navya–Nyaya Doctrine of Negation – Semantics & Ontology of Negative Statements: The Semantics and Ontology of Negative Statements in Navya-Nyaya Philosophy (Harvard Oriental Series) Harvard University Press,1990. | 15 | 01 |
| Total | | | 51 | 3.4 |
| FYUGP 4th Semester | | | | |
| Numerical Methods MTHC5 | Square root, Cube root, Some technical terms and definitions, Computation of Rsines, Desired Rsines and | 1. Lilavati of Bhaskaracharya: Patwardhan, Nainpally, Singh. | 15 | 01 |

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| | <p>Rversines from Jya-sankalita, First, second, etc. repeated summations; Successive corrections to Jya and Sara; Accurate computation of Rsines and Rversines, without using tables; Accurate circumference from an approximate value.</p> | <p>Motilal Banarassdass Publishers, Delhi (2001). 2. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram (Published by Hindustan Book Agency, 2008).</p> | | |
| <p>Ring Theory and Linear Algebra I MTHC7</p> | <p>Unit I and II: The Indian conception of algebra. The treatment of unknown (avyakta), their powers (varga, ghana), and operations with them. Brahmagupta's rules for zero (<i>śūnya</i>) and negative numbers (<i>ṛṇa</i>). Āryabhaṭa's Kuttaka, Unit III and IV: Linear Combinations in the Bakhshali Manuscript, coordinate systems used in Indian planetary models (<i>deśāntara</i> calculations for longitudinal difference).</p> | <p>1. Datta, B., & Singh, A. N. (1938). <i>History of Hindu Mathematics</i>. Motilal Banarsidass. (Part II, Chapter II: Algebra). 2. Bhāskara II – <i>Bījagaṇita</i>, ed. K.S. Shukla, INSA (1976). 3. Krishnamurthy, E. V. (2010). <i>The Kuttaka and Its Applications</i>. Indian Journal of History of Science. 4. Sarma, K. V. (2015). <i>The Bakhshali Manuscript</i>. 5. Van der Waerden, B. L. (1983). <i>Geometry and Algebra in Ancient Civilizations</i>. Springer. (Chapters on Indian algebra).</p> | 09 | 0.6 |
| <p>Algebra MINMTH4</p> | <p>Foundation and History of Algebra. The Six rules for positive and negative numbers, The Six rules for Zero, The Six rules for algebraic numbers, Equation of the form $Ax+c=by$, Equation with one unknown. The ten questions.</p> | <p>1. Bhaskaracharya's Bijaganit and its English Translation; Prof S K Abhayankar; Bhaskaracharya Prasthan Pune, India. 2. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I -</p> | 09 | 0.6 |

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| | | Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram (Published by Hindustan Book Agency, 2008). 3. Hindu Mathematics, B Datta, A. N. Singh, Asia Public House, New Delhi. | | |
| Total | | | 33 | 2.2 |
| FYUGP 5th Semester | | | | |
| Multi-Variate Calculus MTHC9 | Unit II and III: Circle and Circumference: $Bhuja^2 + Koti^2 = Karna^2$; Dividing the circumference into arc-bits: Approximating the arc-bits by $Jy^{-}ardha$ -s (Rsines); Circumference in terms of the Karna-s; Calculation of the circumference; Conversion of the Rsine to arc; Circumference by an alternate method. Diagonals of a cyclic quadrilateral; Product of two full-chords is equal to the difference in the squares of the full-chords associated with half the sum and difference of the arcs; Sum of the products of the two pairs of sides associated with a diagonal is equal to the product of the diagonal with the third diagonal; The area of the cyclic quadrilateral is equal to the product of the three diagonals divided by twice the diameter; Area of the surface of a sphere; Volume of a sphere; The area of the circle; Derivation of the volume of a sphere. | 1. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M. D. Srinivas, and M. S. Sriram, Hindustan Book Agency, 2008. | 09 | 0.6 |
| Group Theory-II | Unit-I: Concept of Parivartana, Nitya-Anitya, | 1. Ganganath Jha, The nyaya-sotras of | 09 | 0.6 |

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| MTHC10 | <p>Vaisheshika Sutra, Symmetry and Transformation in Indian Art and Architecture.</p> <p>Unit II: Cyclicity and periodicity of Indian Music (Tala System), Astronomy (Kalachakra-Cycle of time), Samanya, Vishesh, Nyaya-Vaisheshika.</p> <p>Unit III: Pariṇāma (transformation), Pravṛtti-Nivṛtti cycles in Sāṃkhya&Vedānta, Symmetry in ChandasŚāstra (Pingala, Hemachandra), and ŚulbaSūtras. Hierarchical structures in Indian cosmology (e.g., cyclic kalpas, yugas).</p> <p>Unit IV: Concept of "Avayava–Avayavi" (Part–Whole) relation in Nyāya and Vaiśeṣika systems, Pañcabhūta (Five elements) and the indivisible nature of "anu" (atom) in Vaiśeṣika philosophy, Rigidity and non-factorizability in Sanskrit grammar (Pāṇini's Aṣṭādhyāyī), Nyāya syllogism and Pramāṇa (means of knowledge).</p> | <p>gautama, Vol-1, Motilal Banarsidass,1992.</p> <p>2. Ganganath Jha, The Nyaya-Sutras of Gautama (Vol. 4), Motilal Banarsidass Publishing House, 1999.</p> <p>3. Michael I Selzer, The Symmetry Norm and the Asymmetric Universe, Second edition, Createspace Independent Pub; 4th edition (2017)</p> <p>4. Aruna Rani, Nyaya-Vaisheshika (critical and historical study)</p> <p>5. Datta & Singh-History of Hindu Mathematics, Asia Publishing House, Calcutta, 1962.</p> | | |
| Total | | 18 | 1.2 | |
| FYUGP 6th Semester | | | | |
| <p>Metric Spaces & Complex Analysis</p> <p>MTHC12</p> | <p>Six laws for surds, Law of Signs, Evolution and Involutions, Equation of the form $ax^2 + b = y^2$, Cyclic Method, Possible Genesis of Brahmagupta's Lemma, The power series expansion for sine.</p> | <p>1. Bhaskaracharya's Bij ganit and its English Translation; Prof S K Abhayankar; Bhaskaracharya Pristhan Pune, India.</p> <p>2. Hindu Mathematics, B Datta, A. N. Singh, Asia Public House, New Delhi.</p> <p>3. Was Calculus Invented in India? D</p> | 09 | 0.6 |

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| | | Bressoud, he College Mathematics Journal, Vol. 33, No. 1 (Jan., 2002), pp. 2-13. 4. Mathematics in Ancient India: Brahmagupta's Lemma: The Samasabhavana; Resonance 2003. | | |
| Ring Theory and Linear Algebra-II MTHC13 | Unit I: Ancient Indian remainder-type reasoning in mensuration and algebraic problems. Unit III:Recurrent theme of <i>śakti-kāraṇa</i> (potential–actual) and invariance under transformation. | 1. R. C. Gupta, “Second Degree Equations in Indian Mathematics,” <i>Indian Journal of History of Science</i> , Vol. 4 (1969). 2. K. Sridhar, “Transformational Ideas in Indian Astronomy” — <i>Indian Journal of History of Science</i> . | 09 | 0.6 |
| Number Theory MTHC14A | Unit-I: A glimpse of ancient India; Hindus and mathematics; Scope and development of Hindu mathematics. Numeral terminology; The development of Numerical Symbol; The decimal place-value system; Persistence of the old system; Word numerals; Alphabetic notations; The zero symbol; The place-value notation in Hindu literature. Representation of a number. Eight basic operations on integers and rational numbers: Addition, Subtraction, Multiplication, Division, Square, Square root, Cube and Cube root. Assimilation of fractional increase and decrease. Practical examples. Reverse Computing: Concept and application. Rule of transition, Rule of square transition, ishta method. | 1.P. P. Divakaran, The Mathematics of India: Concepts, Methods, Connections, Springer, 2018. 2. A. K. Bag, Mathematics in Ancient and Medieval India (Chaukhamba, 1979) 3.Indian Contributions to Mathematics and Astronomy: Vedveer Arya, Aryabhata Publications, Hyderabad. (2014). 4.History of Mathematics and Mathematicians of India: Venugopal Heroor: Vidya Bharati, Bangalore. (2006). 5.K. N. Shukla, Aryabhata and the Information Security, International Journal of Innovation in | 15 | 1* |

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| | <p>Practical examples.</p> <p>Unit II: Life and works of Jyestha Devan. Methods for addition, subtraction, multiplication, division, square and square root of natural numbers and fractions.</p> <p>Unit III: Ancient and Medieval India: Arithmetic algorithms; Geometry; Linear congruence; Construction of Sine tables; Transmission to and from India. Diophantine Equations in Greece and India.</p> <p>Unit IV: Katapayādi and Bhūtasamkhyā systems for secret communication and data encoding, precursor ideas to modern cryptography, Algorithmic problem-solving approach in works like SulbaSūtras and Lilāvati, linked to computational number theory.</p> | <p>Science and Mathematics, 4 (2), ISSN (Online): 2347-9051</p> | | |
| <p>Probability and Statistics MTHC-15B</p> | <p>Philosophical foundation of set theory in Indian logic, Probability concepts in ancient Indian texts and games.</p> | <p>1.Sriram, M.S. (2014). Mathematics in Ancient India: Probability and Games of Chance, Indian Journal of History of Science, 49(4), 435-448.</p> | 09 | 0.6* |
| <p>Numerical Methods MINMTH 6</p> | <p>Square root, Cube root, Some technical terms and definitions, Computation of Rsines, Successive corrections to Jya and Sara; Accurate computation of Rsines and Rversines, Accurate circumference from an approximate value. Anticipation of modern mathematical discovery by Kerala Astronomers, Tycho Brahe's Reduction to elliptic, Newton Gauss Interpolation</p> | <p>1. Lilavati of Bhaskaracharya: Patwardhan, Nainpally, Singh. Motilal Banarassdass Publishers, Delhi (2001). 2. "Yuktibhāṣā of Jyeṣṭhadeva: Ganita (Volume I - Mathematics)" translated by K. V. Sarma, with notes by K. Ramasubramanian, M.</p> | 15 | 1 |

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| | formula by Brahmagupta | D. Srinivas, and M. S. Sriram (Published by Hindustan Book Agency, 2008). 3. A History the of Kerella school of Hindu Astronomy, K. V. Sarma, Vishveshvaran and Institute, Hoshairpur, 1972. | | |
| Total | | | 57 | 3.8 |
| FYUGP 7th Semester | | | | |
| Field Theory MTHC16 | Unit I: The SulbaSūtra's use of irrational quantities in geometric constructions. Unit II: Brahmagupta's Brāhmasphuṭasiddhānta's systematic algebraic operations involving zero and negative numbers. Bhāskara II's Bijganita methods for solving polynomial equations and analyzing irreducible forms. Unit III: Symmetry and cyclicity in Āryabhaṭīya and SūryaSiddhānta Unit IV: Pingala's Chandrahśāstra's binary representation (laghu/guru). | 1. Brahmagupta – <i>Brāhmasphuṭasiddhānta</i> (trans. Colebrooke, 1817). 2. Bhāskara II – <i>Bījagaṇita</i> , ed. K.S. Shukla, INSA (1976). 3. Āryabhaṭa – <i>Āryabhaṭīya</i> , trans. K.S. Shukla & K.V. Sarma, INSA (1976). 4. Pingala – <i>Chandaḥśāstra</i> , discussed in Datta & Singh, <i>History of Hindu Mathematics</i> (1935). | 09 | 0.6 |
| Tensor analysis MTHC17 | Concepts of motion, time, and force in Surya Siddhanta and Vaisheshika Sutras, motion under restrictions (Gati and Baddha Gati), Calculating energy-like quantities in ancient Indian astronomical and mechanical models, Early Indian recognition of invariant quantities in motion and celestial dynamics | 1. B. V. Subbarayappa, Indian Contributions to Physics. 2. I.K. Shukla, Analytical Mechanics in Indian Tradition. | 15 | 01 |
| Theory of Equations MTHC18 | Equation of the form $Ax+c=by$, Equation with one unknown. Equation of the form $ax^2 + b = y^2$, Method of Transition, Square Transition, Quadratic | 1. Hindu Mathematics, B Datta, A. N. Singh, Asia Public House, New Delhi. 2. Lilavati of | 09 | 0.6 |

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| | Equation.Kuttaka process. | Bhaskaracharya: Patwardhan, Nainpally, Singh. Motilal Banarassdass 3. Joseph, G. G. (2016). Indian Mathematics: Engaging With The World From Ancient To Modern Times. World Scientific Publishing. | | |
| Advanced Mathematical Logic MINMTH7 | Philosophical foundation of set theory in Indian logic, Nyāya and Vaiśeṣika Systems, Discussion of sambandha (relation) - samavāya (inherence), saṃyoga (contact), and samaveta-samavāya. | 1.K. V. Sarma, A History of the Kerala School of Hindu Astronomy, Vishveshvarananda Institute of Sanskrit and indological Studies, Panjab University, Hoshiarpur 2. B.K. Matilal, Navya–Nyaya Doctrine of Negation – Semantics & Ontology of Negative Statements: The Semantics and Ontology of Negative Statements in Navya- Nyaya Philosophy (Harvard Oriental Series) Harvard University Press,1990 | 09 | 0.6 |
| Total | | | 42 | 2.8 |
| FYUGP 8th Semester | | | | |
| Functional Analysis MTHC19 | Unit I: Development of Numerical Symbolism, Kharoshthi Numerals, Brahmi Numerals; The Decimal place value system, Persistence of the old system, word numerals, alphabetic notations. Unit IV: Progression, Arithmetic Progression, Geometric Progression. Equation of the form | 1. Lilavati of Bhaskaracharya: Patwardhan, Nainpally, Singh. Motilal Banarassdass Publishers, Delhi (2001). 2. Hindu Mathematics, B Datta, A. N. Singh, Asia Public House, New Delhi. | 09 | 0.6 |

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| | $y=ax+b$. | | | |
| Probability and Statistics MINMTH-8 | Philosophical foundation of set theory in Indian logic, Probability concepts in ancient Indian texts and games. | 1.Sriram, M.S. (2014). Mathematics in Ancient India: Probability and Games of Chance, Indian Journal of History of Science, 49(4), 435-448. | 09 | 0.6 |
| Total | | | 18 | 1.2 |

Total percentage of IKS content= **14.25%**

Total hours = **342**

Total Credits = **22.8**

*Credit has been taken either from IKS related course or from the minimum of the optional subjects of the respective semester.