



SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

B.Sc (Environmental Sciences)

Sr. No.	Heading	Particulars
1	Title of the course	B.Sc (Environmental Sciences)
2	Eligibility for admission	HSC with PCB or PCM or Equivalent
3	Minimum percentage	40%
4	Semesters	I and II
5	Level	UG
6	Pattern	04 years & 08 semesters CBGS
7	To be implemented from	From Academic year 2023-24 in a progressive manner



SIES (Nerul) College of Arts, Science and Commerce (Autonomous)
(Affiliated to University of Mumbai)
RE-ACCREDITED GRADE "A" BY NAAC (3rd CYCLE)

BOARD OF STUDIES
SYLLABUS FOR
B.Sc. (Environmental Sciences)

(WITH EFFECT FROM THE ACADEMIC YEAR 2023-2024)

PROGRAMME OBJECTIVES:

1. To exploit opportunities in the Environmental Sciences.
2. To create better avenues for improving employability.
3. To provide exposure to new environmental sciences field
4. To enable increased industry academia interaction

PROGRAMME OUTCOMES:

1. At the end of the programme, students are able to expand through understanding in key areas in the subjects presented.
2. At the end of the programme student get trained to cater to the need for ecological citizenship through developing strong foundation on critical linkage between ecology-society-economy.
3. At the end of the programme, learner will become aware of the importance of working with safety and consciousness in laboratory and actively pursue information about health and environmental safety of chemicals used.
4. At the end of the programme, learner will recognize the need of constant expertized improvement through lifelong lernung

SIES Nerul College of Arts, Science and Commerce (Autonomous)

B.Sc. Environmental Sciences Programme

(To be implemented from Academic Year- 2023-24)

No. of Courses	Course Code	Semester I	Credits
1	Major		
1	U23ES1MJ01	Environment and Ecosystem	4
2	Minor		
2	U23ES1MI01	Basic Chemistry-I	4
3	Open Electives(OE)		
4	U23ES1E01	Environment and Society	4
4	VSC/SEC		
6	U23ES1VSC01	Basics of Computers	2
7	U23ES1SEC01	Introduction to Good Laboratory Practices	2
5	AEC/VEC/IKS		
8	U23ES1AEC01	Effective Communication	2
9	U23ES1VEC01	Understanding Indian Society and Constitutional Values	2
10	U23ES1IKS01	India's Contribution to Mathematics since Ages	2
6	OJT, FP, RP, CEP, CC		
Total Credits			22

Environment and Ecosystem

COURSE CODE: U23ES1MJ01

COURSE CREDIT: 04 (03 theory+01 practical)

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objective: To explain the students with basic concepts of ecology of ecosystems and biodiversity.

Learning Outcome: The learners will reach systematic and updated knowledge about the different components of the ecosystem along with their functioning and gain insight into the biodiversity of India and the world with respect to the threats faced by it and their conservation Aspects.

Sr. No	Syllabus	No. of lectures
01	<p>Module-1- Environment</p> <ul style="list-style-type: none"> ∉ Environment – Definition, Origin of Earth, and components. ∉ Environmental Science - Scope, components, importance of environmental sciences, ∉ Interdisciplinary nature of environmental science ∉ Introduction to Ecology: Definition, Scope, Relation to Other Disciplines, Subdivisions, Modern Branches of Ecology, Applications, and Significance to Human Beings. Evolution and succession. ∉ Ecological adaptations: Adaptations in plants- Hydrophytes, Mesophytes, Xerophytes, Epiphytes, Halophytes; Adaptations in Aquatic and Desert Animals, Adaptations in animals for Flying and Burrowing. ∉ Population Interactions and their types. 	15
02	<p>Module II- Ecosystem</p> <ul style="list-style-type: none"> ∉ Earth & its Structural Components: Formation of the Earth: Internal Structure of Earth Formation and composition of core, mantle, crust. ∉ Theories of geological evolution: Wager's Continental Drift Theory, Plate Tectonic Theory, Sea floor spreading. ∉ Types of Rocks Igneous, Sedimentary, Metamorphic, Rock cycle, 	15

	<ul style="list-style-type: none"> ∄ Rock-forming minerals – quartz, feldspar, micas, clay minerals, calcite, dolomite etc. ∄ Weathering and Soil: Soil, Soil Profile, Soil Formation, Soil classification, Physical & chemical properties of soil, Macro & micro plant nutrients, Importance and Significance of Soil, Soil erosion Types, causes, and effects. ∄ Components of the ecosystem ∄ Biogeochemical Cycles ∄ Types of ecosystems ∄ Biomes and their types 	
03	<p>Module 3-Fundamentals of Biodiversity and Conservation</p> <ul style="list-style-type: none"> ∄ Biodiversity: Definition, Types and Levels of Biodiversity, Importance of Biodiversity, Status of Biodiversity (Global and National), Speciation and Extinction, Threats to Biodiversity, IUCN categories of threats to Biodiversity, Endemism; Endemic species and Endangered Species, Exotic species, ‘Hotspots’ of Biodiversity. ∄ Biodiversity Conservation: ‘<i>In-Situ</i>’ Conservation, ‘<i>Ex- Situ</i>’ Conservation. 	15

Practicals

COURSE CODE	TITLE	CREDITS	HOURS
U23ES1MJ01	Environment and Ecosystem	1	30
<ol style="list-style-type: none"> 1. Identification of ecological adaptations in plants and animals across different habitats. 2. Identification of different types of population interactions. 3. Determination of primary productivity of the terrestrial ecosystem by chlorophyll method. 4. Determination of primary productivity of aquatic ecosystems by light and dark bottle method. 5. Present biogeographic regions of India on map. 6. Prepare a map of Maharashtra showing Protected Area Network (PAN). 7. Identification of global environmental problems. 8. To study the Soil Profile for height, Colour and Texture 			

References:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Mishra, D. D., 2008. Fundamental Concepts of Environmental Studies, S. Chand Publishers, N. Delhi, 271.
3. Eugene P. Odum and Gary W. Barrett (1953), Fundamentals of Ecology (5th edn), brooks/cole, US
4. Charles Krebs (2013), Ecology: Pearson New International Edition (6th Edin).
5. Krishnan, M. S. 1982. *Geology of India and Burma*. CBS Publishers & Distributors.
6. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
7. Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
8. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
9. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.
10. E. P. Odum (1996) Fundamentals of Ecology, Nataraj Publisher, Dehra Dun.
11. K.M.M. Dakshini (1999) Principle and Practices in Plant Ecology, CRC, Boston.
12. M.C. Dash (1994) Fundamentals of Ecology, Tata McGraw Hill, New Delhi.

Basic Chemistry-I

COURSE CODE: U23ES1MI01

COURSE CREDIT: 04 (03 theory+01 practical)

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

To acquaint the students with basic concepts of chemistry viz., nomenclature chemical bonding and stereochemistry.

Learning Outcome: The students will learn elaborate concepts of nomenclature of solutions, classification and buffers. They will also be able to elaborate the chemical bonding types in different compounds along with gaining insight into stereochemistry.

Sr. No	Syllabus	No. of lectures
01	<p>Module-1- Nomenclature, Classification and Solutions, Buffers</p> <p>Nomenclature and Classification of:</p> <ul style="list-style-type: none">€ Inorganic Compounds: Oxides, Salts, Acids, Bases, Ionic, Molecular and Coordination Compounds€ Organic Compounds: Alkanes, Alkenes, Alkynes, Cyclic Hydrocarbons, Aromatic Compounds, Alcohols and Ethers, Aldehydes and Ketones, Carboxylic Acids and its derivatives, Amines, Amides, Alkyl Halides and Heterocyclic Compounds <p>Solutions: Normality, Molarity, Mole fraction, ppb, ppm, millimoles, milliequivalents (Numericals expected).</p> <ul style="list-style-type: none">€ Buffer: Concept of Buffers, Types of Buffers, Derivation of Henderson equation for Acidic and Basic buffers, Buffer action, Buffer capacity (Numericals expected) pH of Buffer Solution.	15
02	<p>Module II- Chemical Bonding</p> <ul style="list-style-type: none">€ Bond length, Bond order Ionic Bond- Nature of Ionic Bond, Structure of NaCl, KCl and CsCl, Factors influencing the formation of ionic bond.	15

	<p>∉ Covalent Bond- Nature of covalent bond, Structure of CH₄, NH₃, H₂O, Shapes of BeCl₂, BF₃.</p> <p>∉ Coordinate Bond- Nature of Coordinate Bond.</p> <p>∉ Non-Covalent Bonds: Van De Waal's forces: dipole - dipole, dipole – induced dipole, Hydrogen Bond.</p>	
03	<p>Module 3-Stereochemistry</p> <p>Stereochemistry: Isomerism, Racemic mixtures Cis-Trans, Threo, Erythro and Meso isomers. Conformation: Conformations of Ethane, Difference between Configuration and Conformation.</p> <p>∉ Configuration: Asymmetric Carbon Atom, Stereogenic/ Chiral Centers, Chirality</p> <p>∉ Projection formulae – Fischer, Newman and Sawhorse, The Interconversion of the Formulae</p>	15

COURSE CODE	TITLE	CREDITS	HOURS
U23ES1MI01	BASIC CHEMISTRY-I	1	30
<ol style="list-style-type: none"> 1. Spot test for compounds belonging to Carboxylic Acid, Phenol, Aldehyde/Ketone, Ester, Alcohol, Amine, Nitro Compounds, Haloalkane, Haloarene. 2. To prepare 0.1 N succinic acid and standardize sodium hydroxide of two different concentrations. 3. Study of neutralization reaction by titration. 4. Estimation of Alcohol by Dichromate method. 5. Preparation of buffers. 			

References:

- Ahluwalia, V. K., 2010 TEXTBOOK OF ORGANIC CHEMISTRY, VOL.III, S. Chand Publishers, Ane Books Pvt. Ltd.
- Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand
- Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
- Ball D.W., Physical Chemistry, Thomson Press, India (2007).
- Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
- Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
- Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005
- Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
- Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).

OE- ENVIRONMENT AND SOCIETY

COURSE CODE: U23ES1E01

COURSE CREDIT: 04

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objective: To orient the students with various movements for the environment.

Learning Outcome: The students will be encouraged to participate in activities that promote environmental conservation and are also made aware of the role of society in environmental management.

Sr. No	Syllabus	No. of lectures
01	Module -1- Introduction to Environment and Society <ul style="list-style-type: none">∅ Concept of environment, Environment and man relationship∅ Scope and Multidisciplinary nature of Environmental Studies∅ Environment education and public awareness∅ Environmental ethics.	15
02	Module-2 - Impact of anthropogenic activities on Environment and Society <p>Impact of the following anthropogenic activities on the environment and society:</p> <ul style="list-style-type: none">• Pollution• Industrialization• Urbanization• Deforestation• Mining• Developmental projects• Reclamation• Tourism	15
03	Module-3 - Man and Environment Management <ul style="list-style-type: none">• Concept and strategies for sustainable development• The Sustainable Development Goals (SDG) 2030 Agenda• Resource utilization and sustainability• Strategies for environmental protection based on	15

	consumerism.	
04	Module-4- Environmental Movements and Society <ul style="list-style-type: none"> • Concept of Social and Environmental Movements • Origin of Environmental movements in India • Case studies of environmental movements (Bishnoi movement, Chipko Movement, Appiko Movement, Narmada Bachao Andolan, Silent Valley movement) • Ideological trends in Environmental Movement 	15

References:

- ∓ A Textbook of Environmental Studies, D. K. Asthana, S Chand & Co Ltd
- ∓ A Textbook of Environmental Chemistry and Pollution Control, S. S. Dara, S Chand & Co Ltd
- ∓ Essential Environmental Studies, S P Misra & S N Pandey, Ane Books Pvt. Ltd.
- ∓ Understanding Environment, Chokkan, K.B., Pandya, H. & Raghunathan, H. (eds). 2004 Sagar Publication India Pvt. Ltd., New Delhi.
- ∓ Pandit, M.K. 2013. Chipko: Failure of a Successful Conservation Movement. In: Sodhi, N.S., Gibson, L. & Raven, P.H. Conservation Biology: Voices from the Tropics. pp. 126- 127. Wiley Blackwell, Oxford, UK.

VSC – Basics of Computers

COURSE CODE: U23ES1VSC01

COURSE CREDIT: 02

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objective: To acquaint the students with Microsoft office and its various tools.

Learning outcomes: Students will learn the basics of computers and to use various toolbars in Microsoft Word, Microsoft Excel and Microsoft PowerPoint.

Sr. No	Syllabus	No. of lectures
01	<p>Module 1- Basics of Computers</p> <p>€ Microsoft Word – Creating new documents; Page Layout; Styles and Themes; Columns and Ordering; Working with Text; Format Text; Text boxes; Listing of Text; Use of various shapes; Use of Tables; SmartArt Graphics; Saving documents.</p> <p>Microsoft Excel – Starting a workbook; Modifying columns rows and cells; Formatting cells; Creating formulas; Formatting Tables; Aligning Texts; Working with Worksheets; Freezing worksheet panes; Use of Charts; Conditional Formatting.</p> <p>€ Microsoft PowerPoint – Uses of PowerPoint presentations; Basics of Presentation slides; Text Basics; Themes and Background styles; Pictures and Clip Art; Viewing and Printing slides; Animating Texts and Objects; Use of Slide Transitions; Slide Show options.</p>	15
02	<p>Module 2- Tutorials</p> <ul style="list-style-type: none">• Tutorials based on Basics of Computers	15

References:

1. Maluth, J. (2016). Basic Computer Knowledge. (n.p.): Amazon Digital Services LLC - Kdp.
2. Wempfen, F. (2014). Computing Fundamentals: Introduction to Computers. Germany: Wiley.
3. Thareja, R. (2019). Fundamentals of Computers. India: Oxford University Press.
4. Foulkes, L. (2020). Learn Microsoft Office 2019: A Comprehensive Guide to Getting Started with Word, PowerPoint, Excel, Access, and Outlook. United Kingdom: Packt Publishing.
5. Habraken, J. (2022). Microsoft Office Inside Out (Office 2021 and Microsoft 365). United States: Microsoft Press.

SEC-Introduction to Good Laboratory Practices

COURSE CODE: U23ES1SEC01

COURSE CREDIT: 02

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objective: to acquaint the students with basic rules, etiquettes, and handling of chemicals in the laboratory.

Learning outcomes: Students will be able to work in the laboratory with the confidence and professional diligence required at the industrial level.

Sr. No	Syllabus	No. of lectures
01	Module 1- Good Laboratory Practices ∅ Basic rules and etiquettes to be followed in a laboratory. ∅ Types of glassware used. ∅ Storage and labeling of chemicals. ∅ Handling of chemicals. ∅ Transfer of chemicals; Use of pipettes. ∅ Disposal of chemicals and housekeeping practices. ∅ Measures to follow in case of accidents and injuries. ∅ Laboratory safety ∅ Personal Protective Equipments	15
02	Module 2- Tutorials • Tutorials based on Good laboratory practices	15

References:

1. Seiler, J. P. (2012). Good Laboratory Practice: The Why and the How. Germany: Springer Berlin Heidelberg.
2. Good Laboratory Practice Regulations, Revised and Expanded. (2002). United States: CRC Press.
3. Good Laboratory Practice Regulations. (1989). Switzerland: M. Dekker.
4. Anderson, M. A. (2002). GLP Essentials: A Concise Guide to Good Laboratory Practice. United Kingdom: Interpharm Press

AEC: Effective Communication Skills-1

COURSE CODE: U23ES1AEC01

COURSE CREDIT: 02

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

1. To develop an awareness among learners about the complexity of the communication process.
2. To develop effective letter-writing skills among students with reference to prescribed layouts and formats.
3. To demonstrate the effective use of communication skills applicable to the employability in present situation.

Course Outcomes:

1. Learner will be aware about the general nature of the Communication process.
2. Learner will be able to write business letters in prescribed layouts and formats.
3. Learner will be able to use different types of oral and written skills to face employability conditions.

Sr. No	Syllabus	No of Lectures
01	Module-1 .Theory of Communication Introduction and Process of Communication, Channels of Communication: Formal /Informal, Vertical, Downward, Upward, Horizontal, Grapevine, Methods of Communication: Verbal/Nonverbal, Barriers in Communication: Physical, Linguistic, Psychological, Sociocultural, Mechanical, Modern Modes of Communication	10
02	Module-2.Business Correspondence -1 Theory of Business Letter Writing,7 Cs of Writing, Format of Letter Writing, Full Block Format, Modified Block Format, Parts of Letter : Major Parts/Minor Parts, Personnel Correspondence: Job Application Letter, Resume, Job Acceptance Letter, Resignation Letter, Recommendation Letter. Professional E mail Writing: Format, Principles of E-mail writing	10

03	<p>Module-3. Language and Writing Skills</p> <p>Paragraph Writing: Developing an idea, Use of appropriate linking devices, Interpretation of Data, Composition on given situation</p> <p>Listening Comprehension, Public Speaking Skills, ICT Enabled Communication, Appropriate use of Non-Verbal Communication, and Multilingual Competency.</p>	10
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Reference Books:

1. A Handbook of Commercial Correspondence by Ashley, A, Oxford University Press, 1992.
2. Basic Business Communication: Skills for Empowering the Internet Generation by Raymond Lesikar and Marie Flatley, 9th Edition, Tata McGraw Hill, New Delhi, 2002.
3. Business Communication by D Chaturvedi and Mukesh Chaturvedi, Third Edition, Pearson Publications Ltd, 2013.
4. Business Communication by Meenakshi Raman and Prakash Singh, Oxford University Press, 2007.
5. Business Communication Strategies by Monippally, Matthukutty, M, Tata McGraw Hill New Delhi, 2001.
6. Effective Business Communication by Herta Murphy, Herbert Hildebrandt, Jane Thomas, Mc Graw Hill Education, 2009.
7. Effective Communication by Balan K.R. and Rayadu C.S., Beacon Publication, New Delhi, 1996.
8. Effective Technical Communication by M.Ashraf, Rizvi, Mc Graw Hill Publications, 2006.

VEC: Understanding Indian Society and Constitutional Values

COURSE CODE: U23ES1VEC01

COURSE CREDIT: 02

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

1. To introduce students to the overview of Indian Society.
2. To help them understand the constitution of India.
3. To acquaint them with the socio-political problems of India.
4. To introduce students to a basic understanding of the Indian Political System.

UNIT	TOPICS	LECTURES
Unit-I Salient features of Indian Society	<ul style="list-style-type: none">● Understand the multi-cultural diversity of Indian society through its demographic composition: Population distribution according to religion, caste, geographical location and gender and age. (3)● Co-existence of traditionalism and Modernism in Indian Society (1)● Values emerging from the diversity in Indian Society (1)	5 Lectures

<p>Unit-II</p> <p>Challenges of Diversity to Unity</p>	<p>Disparity Arising out of-</p> <ul style="list-style-type: none"> ● Regionalism and Linguism-Meaning, causes and Impact (2) ● Casteism and Communalism - Meaning, History, measures to solve these problems. (2) ● Social Inequalities: Meaning, Causes and Effects, (1) ● Gender Inequalities- Treatment and exclusiveness of Women and Other Genders in the society (2) ● Economic/ Wealth Inequalities-Class System and Economic Segregation of the Society (2) ● Measures to improve Equality and Social Justice in the society (1) 	<p>10 Lectures</p>
<p>Unit-III</p> <p>Constitutional Values</p>	<ul style="list-style-type: none"> ● Philosophy of the Constitution as set out in the Preamble (2) ● Features of the Constitution (2) ● Fundamental Rights (2) ● Fundamental Duties (1) ● Directive Principles of State Policy (1) ● Federal structure (2) 	<p>10 Lectures</p>

Unit-IV Significant Aspects of Political Processes	<ul style="list-style-type: none"> ● The party system in Indian politics; (2) ● Local self -government in urban and rural areas; the 73rd and 74th Amendments and their implications for inclusive politics (2) ● Role and significance of women in politics (1) 	5 Lectures
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References-

- Social and Economic Problems in India, Naseem Azad, R Gupta Pub (2011)
- Indian Society and Culture, Vinita Padey, Rawat Pub (2016)
- Urbanisation in India: Challenges, Opportunities & the way forward, I J Ahluwalia, Ravi Kanbur, P K Mohanty, SAGE Pub (2014)
- Regional Inequities in India Bhat L SSSRD- New Delhi
- The Problems of Linguistic States in India, Krishna Kodesia Sterling Pub
- Problems of Communalism in india, Ravindra Kumar Mittal Pub
- Combating Communalism in India: Key to National Integration, KawalKishor Bhardwaj, Mittal Pub
- Khare, R. S. (1998). Cultural diversity and social discontent: Anthropological studies on contemporary India.
- Ganesh, K., & Thakkar, U. (Eds.). (2005). Culture and the making of identity in contemporary India. SAGE Publications India.
- Das, B., & Khawas, V. (2009). Gender issues in development: concerns for the 21st century. (No Title).
- Mandal, B. P. (2011). Cultural Sociology. Centrum Press.
- Rapport, N. (2014). Social and cultural anthropology: The key concepts. Routle
- Oxford Concise Dictionary of Politics, Iain Mclean / Alistair McMillan, Oxford University Press
- Politics, 2nd Edition, Andrew Heywood, Ane Books.

- Dictionary of Politics, D. Robertson, Penguin Books India.
- An Introduction to Political Theory, Gauba, O. P., Macmillan
- Political ideas and concepts : An introduction, Heywood Andrew, Macmillan, Houndmills
- Political ideologies : An introduction, Heywood Andrew, Macmillan, Houndmills
- Oxford Companion to Politics of the World, Krieger Joel Joseph William A Kahler Miles Nzongola – Ntalaja Georges Stallings Barbara B. Weir Margaret, Oxford University Press New York.
- Political Theory, Das Hari Hara and Chaudhari B. C., National Publishing House.
- Introduction to the Indian Constitution, Basu D.D., Wadhwa Publications.
- An Introduction to the Constitution of India, Pylee M V, Vikas Publishing House.
- Introduction to the Constitution of India, Sharma, Brij Kishore, Prentice-Hall of India.
- Our Constitution Kashyap Subhash, National Book Trust.
- Indian Policy for Preliminary Examination, Lakshmikant, Tata McGraw Hill.
- Indian Government and Politics, Narang A.S., Gitanjali Publishing House, New Delhi.
- Introduction to Media and Politics, Sarah Oates, Sage publishers.
- Principles of Modern Political Science, J.C. Johari, Sterling publishers

Indian Knowledge System(credit 2)

India's Contribution to Mathematics since Ages

COURSE CODE: U23ES1IKS01

COURSE CREDIT: 02

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

- € To make students aware about the contribution of India to Mathematics.
- € To make students aware about the several methods of ancient mathematics that will enhance their speed and accuracy in various competitive and placement exams.

Course Outcome:

- Learners will be able to know about the contribution of Indian mathematicians and they will be able to apply several tricks and techniques of Vedic mathematics.

Unit	Details	Lectures
I	<p>The Non-zero Indian Contribution to Mathematics</p> <p>The Indian Number System, The Baudhayana-Pythagoras Theorem, The Mathematics of Language, The Sine Function in Trigonometry, Negative Number, Solution to Quadratic Equations, The Virahanka-Fibonacci Sequence, Binomial Distribution, First Exact Formula for Pie, Geometric Construction with Compass and unmarked Straightedge.</p> <p>Indian Mathematician and their Contribution</p> <p>Aryabhata, Brahamagupta, Mahavira, Bhaskara, Ramanujan, Madhava.</p>	15

II	<p>Sutras</p> <p>Ekadhikena Purvena, Urdhva – tiryagbhyam, Nikhilaṁ navatascaramam Dasataḥ, Paravartya Yojayet, Sunyam Samya Samuccaye, Anurupye Sunyamanyat, Sankalana Vyavakalanbhyam, Ekanyunena Purvena, Yavadunam Tamadun Kartya Varganca Yojayet.</p> <p>Vedic Computation</p> <p>Beejank, Vinculum Numbers, Simultaneous Linear Equations, Magic Squares, Dates and Calendars</p>	15
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References:

1. Vedic Mathematics Made Easy by *Dhaval Bhatiya*, Jaico Publishing House.
2. Vedic Mathematics by *Bharathi Krishna Tripathi*, Motilal Banarsidass Publisher.
3. Cultures and History of Mathematics, by C. S. Seshadri, Hindustan Book Agency.
4. Contributions to the History of Indian Mathematics by *Gerard G. Emch, R. Sridharan and M. D. Srinivas*

Reference Links for preparing Study Material-

- <https://lotusarise.com/salient-features-of-indian-society-upsc/>
- <https://iasscore.in/upsc-syllabus/indian-society/indian-society-mains>
- <https://lotusarise.com/upsc-notes/indian-society-upsc-notes/>
- <https://asiasociety.org/education/indian-society-and-ways-living>
- <https://www.drishtias.com/to-the-points/Paper2/inequality-in-india>