



**Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur 440033**

**Scheme and Syllabus
Bachelor of Science (Mathematics)**

**Submitted by
Board of Studies,
Bachelor of Science (Mathematics)**

B.Sc. Semester I (MATHEMATICS)

<p>Sem I Paper - I</p> <p>DSC (Core) Code: BMT1T01</p> <p>For Minor: BMT1T01</p>	<p>Course Title: Algebra and Trigonometry</p> <p>Course Outcomes:</p> <p>CO1: Foundational Knowledge: Students will be able to update their basics of Set Theory, Matrices, Theory of equations and Complex variables and its applied aspects.</p> <p>CO2: Elementary Skills: Students will be able to understand the importance of hyperbolic functions and their relationships with trigonometric functions.</p> <p>CO3: Basic Analytic skills: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving.</p> <p>CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.</p>	<p>Credit 2</p> <p>No. of hours 30</p>
	<p>Syllabus for B.Sc. Semester – I Paper - I BMT1T01: Algebra and Trigonometry</p>	<p>No. of hours</p>
	<p>Unit I – <u>Algebra</u>: Set theory, equivalence relations, equivalence classes. Theory of Numbers: Divisibility, division algorithm, Euclidean algorithm, congruence, linear congruence.</p>	<p>8</p>
	<p>Unit II - <u>Matrices</u>: Hermitian and skew- Hermitian matrices, idempotent, nilpotent, involuntary, orthogonal and unitary matrices. Rank of a matrix, Equivalent matrices, Row canonical form, Normal form, System of homogeneous and non-homogeneous equations, Characteristic equation and roots, Application of Cayley-Hamilton Theorem.</p>	<p>7</p>
	<p>Unit III – <u>Theory of Equations</u>: Relation between the roots and the coefficients of general polynomial equation in one variable, Descartes’ rule of signs, Calculation of $f(x + h)$ by Horner’s process, Transformation of equations, Reciprocal equations. Solution of cubic Equation (Cardon’s Method) and Biquadratic equations (Ferrari’s Method)</p>	<p>7</p>
	<p>Unit IV - <u>Trigonometry</u>: De Moivre’s Theorem and its application, The n^{th} roots of unity, series expansions of circular, inverse circular and Hyperbolic functions, Separation of $f(z)$ into real and imaginary parts. Logarithm of a complex variable, Properties of logarithmic function.</p>	<p>8</p>
	<p><u>Reference Books:</u></p> <ol style="list-style-type: none"> 1) Elementary Number Theory: David M. Burton (Seventh Edition), New Delhi. 2) Matrix and Linear Algebra: K. B. Datta, Prentice Hall of India Pvt. Ltd., New Delhi- 2000. 3) Higher Algebra: H.S. Hall and S.R. Knight, S. Chand & Co. Ltd., New Delhi, 2008. 	

	<p>4) Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981)</p> <p>5) A Textbook of Matrices: Shanti Narayan, P.K. Mittal, S. Chand & Company, 2010</p> <p>6) Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974)</p> <p>7) Schaum's Outline of trigonometry: Robert Moyer, Frank Ayres, 2012</p> <p>Suggested digital platform: NPTEL/SWAYAM/MOOCs</p>	
PRACTICAL: BMT1P01: Algebra and Trigonometry		
<p>Sem I Paper - I DSC (Core) Code: BMT1P01</p> <p>For Minor: BMT1P01</p>	<p>Course Outcomes:</p> <p>CO1: Students will be able to learn implications of equivalence relations in determining equivalence classes.</p> <p>CO2: Students will understand properties of divisibility through problem solving.</p> <p>CO3: Students will be able to perform different operations on the given congruence.</p> <p>CO4: Solution of linear congruence will be studied by students.</p> <p>CO5: Students will be able to perform matrix operations to determine invertible matrices, row canonical and normal form of the matrices.</p> <p>CO6: Students will be able to apply matrix operations to solve system of linear equations.</p> <p>CO7: Students will be able to find roots of a cubic and biquadratic equation.</p> <p>CO8: Students will be able to apply De Moivre's theorem to find n^{th} roots of a complex number find.</p>	<p>Credit 1</p> <p>No. of hours 30</p>
Syllabus for Practical BMT1P01: Algebra and Trigonometry		
Note: Minimum 12 topics from listed practical problems must be conducted, at least 3 from every unit.		
<u>List of topics for practical problems:</u>		
<p>(1) Comparing relations and functions.</p> <p>(2) Exploring implication of equivalence relations in determining equivalence classes.</p> <p>(3) Properties of divisibility through problem solving.</p> <p>(4) Application of different operations on the given congruence.</p> <p>(5) Solution of linear congruence</p> <p>(6) Matrix algebra: (i) $AB \neq BA$ in general (ii) $A \neq 0, B \neq 0$ but $AB = 0$ (iii) $(AB)' = B' A', (AB)^{-1} = B^{-1} A^{-1}$</p>		

- (7) Different methods of finding Inverse of a matrix.
- (8) Row canonical form, normal form and rank of a matrix.
- (9) Solution of system of linear equations $AX = 0$ and $AX = B$, $B \neq 0$ using row operations.
- (10) Linearly independent and dependent vectors in terms of a row.
- (11) Application of Cayley-Hamilton theorem
- (12) Solving Eigen value problems: Eigen values and eigen vectors of square matrices.
- (13) Calculation of $f(x + h)$ by Horner's method
- (14) Roots of a polynomial equation: Arithmetic, Geometric, Harmonic progression.
- (15) Reciprocal equation, their types, and their solutions.
- (16) Application of Cardano's method to find roots of a cubic equation.
- (17) Application of De Moivre's theorem to find n th roots of a complex number.
- (18) Trigonometric functions, hyperbolic functions and their relations.
- (19) Separation of real and imaginary parts of trigonometric and hyperbolic functions.
- (20) Logarithm of a real valued and complex valued functions.

Reference Books:

1. Elementary Number Theory: David M. Burton (Seventh Edition), New Delhi.
2. Matrix and Linear Algebra: K. B. Datta, Prentice Hall of India Pvt. Ltd., New Delhi- 2000.
3. Higher Algebra: H.S. Hall and S.R. Knight, S. Chand & Co. Ltd., New Delhi, 2008.
4. Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981)
5. A Textbook of Matrices: Shanti Narayan, P.K. Mittal, S. Chand & Company, 2010
6. Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974)
7. Schaum's Outline of trigonometry: Robert Moyer, Frank Ayres, 2012
Suitable computer programs can be used: SageMath/Maxima/SciLab/etc

<p>Sem I Paper - II</p> <p>DSC (Core) Code: BMT1T02</p> <p>For Minor: BMT1T02</p>	<p>Course Title: Differential Calculus</p> <p>Course Outcomes:</p> <p>CO1: Foundational Knowledge: Students will be able to update their basic knowledge of Maxima and Minima of functions of single variables and their application.</p> <p>CO2: Elementary Skills: Students will undergo problem solving training by learning Indeterminate forms and L' Hospital's Rule and their applicability.</p> <p>CO3: New Concepts learning: Students will be able to learn new concept of functions of two variables, Taylor series, and maxima and minima of such functions.</p> <p>CO4: Analytic Skills: The problem-solving skills will bring forth the importance of Jacobian in understanding the existence of inverse transformation and other aspects of independence of pair of functions.</p> <p>CO5: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.</p>	<p>Credit 2</p> <p>No. of hours 30</p>
<p>Syllabus for BSc Semester – I Paper -II BMT1T02: Differential Calculus</p>		<p>No. of hours</p>
<p>Unit I – <u>Functions of Single Variable – Part 1:</u> Intermediate value theorem, Rolle's Theorem, Mean value theorems and their geometrical interpretations, Applications of mean value theorems. Maxima and Minima; cases of one variable involving second or higher degree polynomials</p>		<p>8</p>
<p>Unit II – <u>Functions of Single Variable – Part 2:</u> Successive differentiation and n^{th} differential coefficient of functions, Leibnitz's theorem, Maclaurin's and Taylor's theorems, Indeterminate forms and L' Hospital's Rule</p>		<p>7</p>
<p>Unit III - <u>Functions of Two Variables – Part 1:</u> Limit and continuity of functions of two variables, Partial derivatives, Homogeneous functions, Total differentials, Composite functions, Asymptotes.</p>		<p>7</p>
<p>Unit IV - <u>Functions of Two Variables – Part 2:</u> Jacobians and its properties, Taylor's series of function of two variables, Maxima and Minima of function of two variables, Lagrange's method of multiplier.</p>		<p>8</p>
<p><u>Reference Books:</u></p> <ol style="list-style-type: none"> 1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014). 2. Introduction to Real Analysis: R.G. Bartle & D.R. Sherbert, , John Wiley & Sons, 1999 3. Calculus: T.M. Apostol, Vol. I, John Wiley & Sons Inc., 1974 		

	<p>4. A Basic Course in Real Analysis: Ajit Kumar and S. Kumaresan, CRC Press, 2019</p> <p>5. Differential Calculus: S. Balachandra Rao & C. K. Shantha, New Age Publication 1992</p> <p>6. Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007</p> <p>7. Calculus: G. B. Thomas and R.L. Finney, Pearson Education, 2010</p> <p>Suggested digital platform: NPTEL/SWAYAM/MOOCs</p>	

Sem I Paper - II	PRACTICAL: BMT1P02: Differential Calculus	
DSC (Core) Code: BMT1P02 For Minor: BMT1P02	<p>Course Outcomes:</p> <p>CO1: Students will be able to make out the maximum or minimum nature of the functions by applying different conditions on the functions.</p> <p>CO2: Working on Geometric interpretation of Mean value theorems through graphs of a function will make students grasp the subject admirably.</p> <p>CO3: Students will learn application of Leibnitz, Maclaurin's and Taylor's theorems.</p> <p>CO4: Students will be able to apply L' Hospital's Rule to solve the problems</p> <p>CO5: Solving problems when functions involved are homogeneous</p> <p>CO6: Students will able to solve Jacobians and learn properties due to Jacobian.</p> <p>CO7: Analyzing Maxima and Minima of functions of two variables</p>	<p>Credit 1</p> <p>No. of hours 30</p>
	<p>Syllabus for Practical BMT1P02: Differential Calculus Note: Minimum 12 topics from listed practical problems must be conducted, at least 3 from every unit.</p>	
	<p><u>List of topics for practical problems:</u></p> <ol style="list-style-type: none"> (1) Application of Rolle's theorem (2) Geometric interpretation of Mean value theorems through graph of a function (3) Application of Mean Value Theorems (4) Comparing results due to Rolles' theorem and Lagrange's mean value theorem on a given function with different conditions. (5) Application of Intermediate value theorem, and analyze it through its graph (6) Determination of n^{th} differential coefficient of functions (7) Application of Leibnitz's theorem (8) Application of Maclaurin's theorem and Taylor's theorems (9) Comparing different Indeterminate forms, and their conversions if possible (10) Solution of limiting problems using L' Hospital's Rule (11) Performing iterative limits on functions of two variables (12) Solving partial derivatives for functions of two variables (13) Solving problems when functions involved are homogeneous 	

	<p>(14) Solving total differentials of scalar functions</p> <p>(15) Finding asymptotes of a function and analyze it through its graph.</p> <p>(16) Solving Jacobians of functions f & g</p> <p>(17) Analyzing independent nature of functions f & g through Jacobians</p> <p>(18) Verification of $J J' = 1$ for a given function and analyze existence of inverse transformation</p> <p>(19) Analyzing Maxima and Minima of function of two variables</p> <p>(20) Application of Lagrange's method of multiplier</p> <p><u>Reference Books:</u></p> <ol style="list-style-type: none"> 1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014). 2. Introduction to Real Analysis: R.G. Bartle & D.R. Sherbert, , John Wiley & Sons, 1999 3. Calculus: T.M. Apostol, Vol. I, John Wiley & Sons Inc., 1974 4. A Basic Course in Real Analysis: Ajit Kumar and S. Kumaresan, CRC Press, 2019 5. Differential Calculus: S. Balachandra Rao & C. K. Shantha, New Age Publication 1992 6. Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 7. Calculus: G. B. Thomas and R.L. Finney, Pearson Education, 2010 <p>Suitable computer programs can be used: SageMath/Maxima/SciLab/etc</p>	

Vocational Skill Enhancement Course (VSC)

SEMESTER - I

VSC – 01 : Sage Math Software System

Sage is free, open-source Mathematics software that supports research and teaching in algebra, geometry, number theory, cryptography, numerical computation, and related areas.

(Download from <http://www.sagemath.org/>)

SYLLABUS

	<u>PRACTICAL: Sage Math Software System</u>	
Sem- I	Course Title: SAGE MATH SOFTWARE SYSTEM	Credit 2
VSC - 01	Course Outcomes: Students will be able	No. of hours 30
Code:	1) to explore topics in Calculus, Applied Linear Algebra and Numerical Method along with several applications 2) to learn an alternative software as against the commercial products Magma, Maple, Mathematica and MATLAB 3) to learn the most recent algorithms and tools for many domains of mathematics 4) to use as wonderful scientific and graphical calculator.	
BVS1P01	Syllabus for BSc Semester – I: VSC - 01 Code BVS1P01: SAGE MATH SOFTWARE SYSTEM	No. of hours
	TOPICS: 1. Introductory Tutorial 2. Evaluating Sage Commands 3. Functions in Sage 4. Annotating with Sage 5. Basic Symbolics and Plotting 6. Basic 2D Plotting 7. Basic 3D Plotting 8. Calculus 1- Differentiation 9. Calculus 2- Integration 10. Advanced 2D Plotting 11. Graphing Functions and Plotting Curves 12. Plotting Data	30
	Reference books / materials: 1. Computational Mathematics with Sage Math, By <u>Paul Zimmermann</u> , Alexandre Casamayou, <u>Nathann Cohen</u> , <u>Guillaume Connan</u> , <u>Thierry Dumont</u> , <u>Laurent Fousse</u> , François Maltey, Matthias Meulien, <u>Marc Mezzarobba</u> , <u>Clément Pernet</u> , <u>Nicolas M. Thiéry</u> , Erik Bray, <u>John Cremona</u> , Marcelo Forets, <u>Alexandru Ghitza</u> , Hugh Thomas. 2. https://doc.sagemath.org/html/en/prep/index.html 3. https://www.ictmumbai.edu.in/Mathematics/SageMath Lecures_AjitKumar_ICT Mumbai.pdf 4. http://lamastex.org/preprints/compSageMathZimmerman120517.pdf 5. ajitmathsoft.wordpress.com/sage-math	

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7 Hrs)

- A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
- B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
- C. Components of Environment: Atmosphere (Structure and composition), hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere-Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7 Hrs)

- A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
- B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
- C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (8 Hrs)

- A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
- B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
- C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (8 Hrs)

- A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
- B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y-shaped). Energy flow and the law of thermodynamics.
- C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i) Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	8
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhvajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	8
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	7
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	7
	TOTAL	30 HRS

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution of Civil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Sem- II Paper - I DSC (Core) Code: BMT2T03 For Minor: BMT2T03	Course Title: Integral Calculus and Ordinary Differential Equations Course Outcomes: CO1: Foundational knowledge: Students to update their knowledge of improper integrals, Beta and Gamma functions and their applicability. CO2: Basic skills: Students will be able to understand the importance of varied methods of solving differential equations of first and second order. CO3: Analytical skills: The main objective of the course is to equip students with necessary analytic skills due to integrability and solutions of differential equations. CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	Credit 2 No. of hours 30
	Syllabus for BSc Semester – II Paper - I BMT2T03: Integral Calculus and Ordinary Differential Equations	No. of hours
	Unit I - <u>Reduction Formulae and Beta, Gamma Functions:</u> Reduction formulae for basic trigonometric functions, Integration of irrational functions, Beta and Gamma functions, their properties, Relation between Beta and Gamma functions, Evaluation of integrals using Beta and Gamma functions.	8
	Unit II – <u>Multiple Integrals:</u> Double integration, Application of double integrals, Change the order of integration, Change of variable, Triple integration.	7
	Unit III – <u>First Order Differential Equations:</u> Exact differential equations, Integrating factors, Linear and Bernoulli’s differential equations, First order higher degree differential equations solvable for x, y and p, Clairaut’s form, Orthogonal trajectories.	7
	Unit IV - <u>Second Order Linear Differential Equations:</u> The general solution of the homogeneous equations, Operator methods for finding particular solutions, Euler’s Equidimensional Equations, Use of a known solution to find another, The method of variation of parameters.	8
	<u>Reference Books:</u> 1) Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). 2) Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991. 3) Calculus: T.M. Apostol, Vol. I, John Wiley & Sons Inc., 1974 4) Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 5) Calculus: G.B. Thomas and R.L. Finney, Pearson Education, 2010. Suggested digital platform: NPTEL/SWAYAM/MOOCs	

Sem- II Paper - I	PRACTICAL: BMT2P03: Integral Calculus and Ordinary Differential Equations	
DSC (Core) Code: BMT2P03 For Minor: BMT2P03	<p>Course Outcomes:</p> <p>CO1: Students will be able to solve problems using reduction formulae, Beta and Gamma functions.</p> <p>CO2: Application of double integration in solving problems on area of a region.</p> <p>CO3: Students will be able to solve problems by changing the order of integration</p> <p>CO4: Students will learn application of triple integration</p> <p>CO5: Students will be able to apply integrating factor in solving non-exact differential equations</p> <p>CO6: Students will be able to solve Euler's Equidimensional Eqs</p> <p>CO7: Students will be able to use concept of Wronskian in solving problems by method of variation of parameters</p>	Credit 1 No. of hours 30
	<p>Syllabus for Practical BMT2P03: Integral Calculus and Ordinary Differential Equations</p> <p>Note: Minimum 12 topics from listed practical problems must be conducted, at least 3 from every unit.</p>	
	<p><u>List of topics for practical problems:</u> <u>Abbreviations: Eq- Equation, DEq – Differential Equations</u></p> <ol style="list-style-type: none"> (1) Application of Reduction formulae for basic trigonometric functions (2) Solving problems of integration of irrational functions (3) Properties of Beta and Gamma functions (4) Relationship between Beta and Gamma functions (5) Solution of integrals using Beta and Gamma functions. (6) Solution of problems involving double integration (7) Application of double integration in solving problems on area of a region (8) Solving problems by changing the order of integration (9) Solution of double integral using polar coordinates (10) Learning triple integration through examples (11) Solving exact DEqs (12) Comparing exact and non-exact DEqs, and need of integrating factor in solving non-exact DEqs 	

	<p>(13) Solution of Bernoulli's DEqs</p> <p>(14) Solutions of First order higher degree DEqs</p> <p>(15) Finding orthogonal trajectory of the given family, and then sketch both the families together to decipher the orthogonality</p> <p>(16) Application of Wronskian in understanding the independent/dependent nature of functions</p> <p>(17) Solutions of homogeneous DEqs</p> <p>(18) Solutions of Euler's Equidimensional Eqs</p> <p>(19) Determination of a solution from a known solution</p> <p>(20) Application of method of variation of parameters</p> <p><u>Reference Books:</u></p> <p>(1) Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005).</p> <p>(2) Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991.</p> <p>(3) Calculus: T.M. Apostol, Vol. I, John Wiley & Sons Inc., 1974</p> <p>(4) Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007</p> <p>(5) Calculus: G.B. Thomas and R.L. Finney, Pearson Education, 2010.</p> <p>Suitable computer programs can be used: SageMath/Maxima/SciLab/etc</p>	

Sem- II Paper - II DSC (Core) Code: BMT2T04 For Minor: BMT2T04	Course Title: Vector Analysis	Credit 2
	Course Outcomes: CO1: Foundational knowledge: To impart foundational knowledge of vector algebra and vector differentiation. CO2: Basic skills: To inculcate in students foundational base of gradient of a scalar function, divergence and curl. CO3: Concept learning: New concept of vector integration shall be introduced and problems of work done by force shall be solved. CO4: Application of Vector Theorems: To solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem. CO5: Application: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects.	No. of hours 30
	Syllabus for BSc Semester – II Paper -II BMT2T04: Vector Analysis	No. of hours
	Unit I – Vector Differentiation: Vector triple products, product of four vectors, ordinary derivatives of vectors, space curves, continuity and differentiability, differentiation formulae, partial derivatives of vectors, differentials of vectors.	8
	Unit II - Gradient, Divergence and Curl: The vector differential operator del, Gradient, directional derivatives, Divergence, solenoidal vector, Curl, irrotational vector field.	7
	Unit III - Vector Integration: Ordinary integrals of vectors, Line Integral, Work done by force, exact differential and scalar potential, Surface integral, Volume integral.	7
	Unit IV – Vector Theorems: Green's Theorems in the plane (statement only), Gauss divergence Theorem (statement only), Stokes' Theorem (statement only) and their applications.	8
Reference Books: 1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974) 2. Introduction to Vector Analysis: N. Saran and S. N. Nigam, Pothishala Pvt. Ltd. Allahabad. 3. Vector Analysis: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). Suggested digital platform: NPTEL/SWAYAM/MOOCs		

	PRACTICAL: BMT2P04: Vector Analysis	
Sem- II Paper - II DSC (Core) Code: BMT2P04 For Minor: BMT2P04	Course Outcomes: CO1: Students will be able to update themselves with foundational knowledge of vector algebra and vector differentiation by solving examples. CO2: The basic skills required in science will be ingrained in students through foundational base of gradient of a scalar function, divergence and curl by solving examples. CO3: New concept of vector integration shall be learnt by students and problems of work done by force shall be solved by them. CO4: Students will be able to solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem. CO5: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects, and this will help students immensely in their future.	Credit 1 No. of hours 30
	Syllabus for BSc Semester – II Paper -II Practical BMT2P04: Vector Analysis Note: Minimum 12 topics from listed practical problems must be conducted, at least 3 from every unit.	
	<u>List of topics for practical problems:</u> (1) Application of product of four vectors (2) Determination of ordinary derivatives of the functions (3) Finding partial derivatives of the functions (4) Determination of differentials of vector functions (5) Solving examples involving gradient of the scalar function, and plotting its graph (6) Application of gradient of function in obtaining directional derivatives (7) Application of divergence in determination of solenoidal vector (8) Learning concept of curl of vector function (9) Application of curl in irrotational/rotational field (10) Performing gradient operation in calculating angle between the surfaces (11) Solving ordinary integrals of vectors (12) Solving line integrals along various paths (13) Application of work done by force along different paths, and to verify if it is independent of the paths (14) Application of surface integrals (15) Application of volume integrals (16) Solving problems by Green's theorem in the plane	

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| <p>(17) Application of Green's theorem in the plane</p> <p>(18) Determination of area by Greens's theorem in the plane</p> <p>(19) Application of Gauss theorem</p> <p>(20) Application of Stokes' theorem</p> <p><u>Reference Books:</u></p> <ol style="list-style-type: none">1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974)2. Introduction to Vector Analysis: N. Saran and S. N. Nigam, Pothishala Pvt. Ltd. Allahabad.3. Vector Analysis: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). <p>Suitable computer programs can be used:
SageMath/Maxima/SciLab/etc</p> | |
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BSc Semester – II
Vocational Skill Enhancement Course (VSC)
SEMESTER - II
VSC -02 : Maxima Software System

Maxima is a free, open source computer algebra system, which is primarily used for symbolic computation, including differentiation, integration, Taylor series, Laplace transforms, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices and tensors.

<u>Maxima Software System</u>		
Sem- II	PRACTICAL:	Credit
VSC - 02	<u>Course Outcomes:</u>	2
Code:	Students will be able	No. of
BVS2P03	<ol style="list-style-type: none"> 1. to develop skills to deliver practical knowledge in its application 2. to explore topics in Calculus, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices 3. to provide algorithms and tools for many domains of mathematics 4. to use as wonderful scientific and graphical calculator 	hours
	Syllabus for BSc Semester – II: VSC - 02	No. of
	Code BVS2P03: MAXIMA SOFTWARE SYSTEM	hours
	TOPICS:	30
	<ol style="list-style-type: none"> 1. Introduction to Maxima 2. Mathematical functions in Maxima 3. Plotting: 2D and 3D graphical output. 4. Polynomials: Standard forms for polynomials, and Maxima functions operating on them 5. Limits: Limits of expressions 6. Differentiation: Differential calculus 7. Integration: Integral calculus 8. Equations: Defining and solving equations 9. Differential Equations: Defining and solving differential equations 10. Numerical: Numerical integration 11. Matrices: Matrix operations 12. Number Theory: Number theory problems 	

	<p>Reference Books:</p> <ol style="list-style-type: none">1. Computational Mathematics Using Maxima Software - Paper 3 - A Manual for SY BSc Mathematics , Dr. Kalyanrao Takale, Dr. Amjad Shaikh, Dr. Veena Kshirsagar, Dr. Shrikisan Gaikwad, Prof. S. R. Patil.2. Computational Mathematics Using Maxima Software , Dr. K Takale, Dr. S Gailwad, Dr. A Shaikh, Dr. V Kshirsagar, Dr. V Jadhav, Prof. S Patil.3. Mathematics for Engineers and Science Labs Using Maxima, 1st Edition, by <u>Seifedine Kadry, Pauly Awad</u>.4. Algebra And Calculus Using Maxima Software, <u>Dr. K. C. Takale, Dr. A. S. Shaikh, Dr. V. S. Jadhav, Dr. S. B. Gaikwad, Prof. S. R. Patil, Nirali Prakashan.</u>	

SEM 2 : CONSTITUTION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity
- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

- 1.** It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
- 2.** The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
- 3.** Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	8
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	8
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	7
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	7
	TOTAL	30 HRS

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao. Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, <https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf>