Rayat Shikshan Sanstha's
Sadguru Gadage Maharaj College, karad
(An Autonomous College)
DEPARTMENT OF MATHEMATICS

# Department of Mathematics

## B. Sc. I

## Semester I & II

## NEP syllabus to be implemented from July 2024 Onwards

# Semester: I

## Subject Code: - BMT24-101

## Paper I: Differential Calculus (Credit 02)

**Course Outcomes (COs):**

**On completion of the course, the students will be able to:**

1. calculate the limit and examine the continuity of a function at a point.
2. employ theorem on properties of continuity in various examples.
3. understand the consequences of various mean value theorems for differentiable functions.
4. understand and apply higher order derivatives, Taylor's theorem and indeterminate form

| UNIT | Contents | Hours Allotted |
|---|---|---|
| 1 | **Limit And Continuity:**<br>1.1 Definition of limit of a real-valued function<br>1.2 Algebra of limits<br>1.3 Limit at infinity and infinite limits<br>1.4 Definition: Continuity at a point and Continuous functions on interval<br>1.5 Theorem: If f and g are continuous functions at point x = a, then $f+g,\ f-g, f\cdot g$ and $\frac{f}{g}$ are continuous at point.<br>1.6 Theorem: Composite function of two continuous functions is continuous.<br>1.7 Examples on continuity.<br>1.8 Classification of Discontinuities (First and second kind),Removable Discontinuity, Jump Discontinuity. | 08 |
| 2 | **Properties of continuity of Real Valued functions:**<br>2.1 Theorem: If a function is continuous in the closed interval [a, b] then it is bounded in [a, b]<br>2.2 Theorem: If a function is continuous in the closed interval [a, b], then it attains its bounds at least once in [a, b].<br>2.3 Theorem: If a function f is continuous in the closed interval [a, b] and if f(a) and f(b) are of opposite signs then there exist $c \in (a, b)$such that f(c) = 0.<br>2.4 Theorem: If a function f is continuous in the closed interval [a, b] then f assumes every value between f (a) and f (b).<br>2.5 Uniform continuity. | 05 |
| 3 | **Differentiability:**<br>3.1 Differentiability of a real-valued function<br>3.2 Geometrical interpretation of differentiability<br>3.3 Relation between differentiability and continuity<br>3.4 Chain rule of differentiation<br>3.5 Mean Value theorems: Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem<br>3.6 Geometrical interpretation of mean value theorems.<br>3.7 Partial differentiation | 08 |
| 4 | **Successive differentiation**<br>4.1 Successive differentiation definition and examples<br>4.2 Leibnitz's theorem and its application | 09 |

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|---|---|---|
| | 4.3 Maclaurin's and Taylor's theorems<br>4.4 Maclaurin's and Taylor's expansion for standard function<br>4.5 Indeterminate form. | |

**Recommended Books:**

1. Shanti Narayan, Dr. P. K. Mittal, Differential Calculus, S. Chand Publications

2. Gorakh Prasad, Differential Calculus (19 th edition). Pothishala Pvt. Ltd. (2016).

**Reference Books:**

1. Hari Kishan, Calculus, Atlantic Publishers.

2. Michael Spivak, Calculus, Cambridge University Press.

## Subject Code: - BMT24-102

# Paper II: Basic Algebra and Complex Numbers (Credit-02)

**Course Outcomes (COs)**

**On completion of the course, the students will be able to:**

1. understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots
2. apply De Moivre's theorem in a number of applications to solve numerical problems.
3. recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
4. find eigenvalues and corresponding eigenvectors for a square matrix.

| UNIT | Contents | Hours Allotted |
|---|---|---|
| 1 | **Theory of Equations**<br>1.1 Elementary theorems on the roots of an equations<br>1.2 The remainder and factor theorems, Synthetic division<br>1.3 Factored form of a polynomial.<br>1.4 The Fundamental theorem of algebra.<br>1.5 Relations between the roots and the coefficients of polynomial equations<br>1.6 Integral and rational roots. | 07 |
| 2 | **Complex Numbers:**<br>2.1 Introduction<br>2.2 Polar representation of complex numbers<br>2.3 De Moivre's theorem (integer and rational indices)<br>2.4 Roots of a complex number, expansion of $\cos n\theta, \sin n\theta$<br>2.5 Euler's exponential form of a complex number<br>2.6 circular function and its periodicity<br>2.7 Hyperbolic function | 08 |
| 3 | **Matrices:**<br>3.1 Transpose of matrix, Conjugate of matrix, Transposed- conjugate of a matrix<br>3.2 Row reduction and echelon forms<br>3.3The rank of a matrix and applications, Inverse of matrix<br>3.4 Eigenvalues and eigenvectors of matrix<br>3.5 Cayley-Hamilton theorem and its application | 08 |
| 4 | **System of linear equations**<br>4.1 Homogeneous linear equations<br>4.2 Nature of solution of homogeneous equation<br>4.3 Non – Homogeneous linear equations<br>4.4 Working rule for finding solution of homogeneous equation | 07 |

**Recommended Books:**


1. W. S. Bunside and A. R. Panton: The Theory of Equations: With an Introduction to theTheory of Binary Algebraic Forms, Dover Phoenix Editions, 2005.
2. Brown and Churchill, Complex Variables and Applications, 7th Edition, McGraw Hill, 2010.
3. Serge Lang: Introduction to Linear Algebra, Second Edition, 1986.

**Reference Books:**

**1.**M.L. Khanna, Theory of Equations, Jai Prakash Nath and Company.

2.P.N. Wartikar, J.N. Wartikar, A Textbook of Applied Mathematics, Pune Vidyarthi Griha Prakashan, Pune.

3.A. R. Vasishtha, A. K. Vasishtha, Matrices, Krishna Prakashan Media(P) Ltd,Meerut.

4. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall of India, New Delhi, 1999.

## Course Code: - BMP24-103
## MATHEMATICS PRACTICAL - I

### Practical: Examples on

1. Rolle ’s Theorem.
2. Lagrange’s mean value.
3. Indeterminate form.
4. Successive differentiation.
5. Factor theorem and Synthetic division.
6. De Moivre’s theorem.
7. Eigenvalues and Eigenvectors.
8. Cayley-Hamilton theorem.
9. Homogeneous linear equation.
10. Non homogeneous linear equation.

## SEMESTER- I

## Paper Code: - OEMAT24-101

## Quantitative Aptitude for Competitive Exam –I (Credit 02)

**Course Outcomes (COs)**

**On completion of the course, the students will be able to:**

1. understand the basic concepts of quantitative ability
2. familiarize basic concepts of Permutation and Combinations.
3. solve geometrical problems by using short-cut method
4. complete in various competitive exams like CAT, CMAT, GRE, GATE,UPSC, GPSC etc.

| UNIT | Contents | Hours Allotted |
|---|---|---|
| **1** | 1.1 Progression and Sequence.<br>1.2 Series.<br>1.3 Fractions. | 06 |
| **2** | 2.1 Percentage.<br>2.2 Profit and Loss.<br>2.3 Allegation and Mixtures.<br>2.4 Ratio and Proportion. | 08 |
| **3** | 3.1 Triangles.<br>3.2 Quadrilaterals.<br>3.3 Circles.<br>3.4 Cylinders.<br>3.5 Cones.<br>3.6 Spheres. | 10 |
| **4** | 4.1 Permutation.<br>4.2 Combination. | 06 |

**Reference Books:**

1. R. S. Aggarwal, Quantitative Aptitude, S. Chand Publications.

## SEMESTER I

## (IKS)

## Subject Code: IKSM24-101

## Interdisciplinary Course in Generic IKS (Credits – 02)

**Course Outcomes (COs)**

**On completion of the course, the students will be able to:**

1. inculcate ayurvedic practices in health
2. apply traditional knowledge for sustainability
3. follow dincharya and daily regime and appropriate food for the maintenance of good health.

| UNIT | Contents | Hours Allotted |
|---|---|---|
| I | **Introduction to Indian Knowledge System**<br>a)Introduction to IKS<br>1.Definition, Concept and Scope of IKS<br>2.IKS based approaches on Knowledge Paradigms<br>3.IKS in ancient India and in modern India<br>b)Importance of Health& Wellness in IKS<br>1.Ayurveda -Importance of Sleep and Food,<br>2.Role of water in wellbeing<br>3.Yoga and Triguṇa System .Healthy regimen to maintain state of wellbeing<br>4. Dinacharya, the Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene. | **15** |
| II | **Life sciences, Environment, and Health**<br>a) Life sciences, Environment, and Health<br>1. Life Science - Plants-Herbal medicines, Herbal preparations, modern herbal medicines , Herbal medicines from *Allium sativum* , Neutraceuticals,<br>2. Traditional probiotic foods and their importance in human health<br>3. Ecology and Environment-Concept & structure of ecosystem, kinds of ecosystem, functions of ecosystem,<br>4. Āyurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery, and Yoga, etc.<br>b) Basic principles of Food, Nutrition from Ayurveda<br>1. Understanding rich sources of nutrients<br>2. Concept of Doshas & assessment<br>3. Ayurvedic Principles of food habits and factors determining quality of food (Ahara vidhi visheshaayatana)<br>4. FSSAI regulations on Ayurvedic Aahar | **15** |

**Recommended Books:**

1. Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-02.
2. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Allium Sativum: Chemical Constituents, Medicinal Uses and Health Benefits Plant science research and practices- Nova Science Publishers, Incorporated, 2016.

## Reference Books:

1. Gambirananda, Swami, Tr. Upanishads with the Commentary of Sankarachrya. Kolkata: Advaita Ashrama publication Department, 2002.
2. Ranganathananda, Swami. The Massage of the Upanishads. Bombay: Bharathya Vidya Bhaven,1985. 8. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985
3. J Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshi ramManoharlal publication, 1994.

# Semester: II

## Subject Code: - BMT24-201

# Paper III: Differential Equations - I (Credit 02)

**Course Outcomes (COs)**

**On completion of the course, the students will be able to:**

1. learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations
2. calculate Particular integral and Complementary function of different types of differential equation
3. solve differential equation of degree more than one.
4. learn techniques of solving Clairaut's Equation.

| UNIT | Contents | Hours Allotted |
|---|---|---|
| **1** | **Differential Equations of first order and first degree:**<br>1.1 Types of Differential equation, order and degree of differential equation.<br>1.2 Exact Differential equations.<br>1.2.1 Necessary and sufficient condition for exactness.<br>1.2.2 Working Rule for solving an exact differential equation.<br>1.2.3 Integrating Factor (I.F.) by using rules (without proof).<br>1.3 Linear differential Equation, Method of solution.<br>1.4 Bernoulli's differential Equation, method of solution.<br>1.5 Orthogonal trajectories: Cartesian and polar co-ordinates. | 08 |
| **2** | **Linear Differential Equations with constant Coefficients:**<br>2.1 Definition: Complementary function (C.F.) and particular integral (P.I.).<br>2.2 General Solution of f(D) y=0.<br>2.2.1 When all the root of the A.E. are real and different.<br>2.2.2 When all the root of the A.E. are equal.<br>2.2.3 When A.E. has complex roots.<br>2.2.4 When the A.E. has surd roots.<br>2.3 Solution of D(y) = X,<br>2.3.1 X = $e^{ax}$, *where a is constant*<br>2.3.2 $X = \sin(ax)$ *and* $\cos(ax)$<br>2.3.3 X = $x^m$, m is positive integer<br>2.3.4 X = $e^{ax}V$, *where V is a function of x*<br>2.3.5 X = $xV$, *where V is a function of x.* | 12 |
| **3** | **Equations of first order but not first degree**:<br>3.1 Equations that can be factorized.<br>3.1.1 Equation solvable for p.<br>3.2 Equations that cannot be factorized.<br>3.2.1 Equation solvable for x.<br>3.2.2 Equation solvable for y. | 06 |
| **4** | **Clairaut's Equation**:<br>4.1 Clairaut's form.<br>4.2 Method of solution and examples. | 04 |

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|---|---|---|
| | 4.3 Equation reducible to Clairaut's form.<br>4.4 Special form reducible to Clairaut's form. | |

**Recommended Books:**

1.Daniel A. Murray, Introductory course in Differential Equations, Orient Longman.

2. Diwan, Agashe, Differential Equations, Popular Prakashan, Mumbai.

**Reference Books:**

1. M. L. Khanna, Differential Equations, Jai Prakash Nath and Company.

2. Dr. M. D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publications.

## Subject Code: - BMT24-202

# Paper IV: Geometry (Credit 02)

**Course Outcomes (COs)**

**On completion of the course, the students will be able to:**

1. define the translation, rotation and understand relation between rotation and translation.
2. estimate polar equation of circle, conic, chord, tangent.
3. understand the various equation of sphere.
4. learn various equation forms of cone.

| UNIT | Contents | Hours Allotted |
|---|---|---|
| 1 | **Changes of axes:**<br>1.1 Changes of axes by Translation<br>1.2 Changes of axes by Rotation<br>1.3 Changes of axes by Translation and Rotation<br>1.4 Rotation followed by Translation<br>1.5 Translation followed by Rotation<br>1.6 Invariants, Basic theorems | 06 |
| 2 | **Polar Coordinates:**<br>2.1 Polar equation of circle:<br>2.1.1 Centre – radius form<br>2.1.2 Centre at the pole<br>2.1.3 Passing through the pole and touching the polar axis at the pole<br>2.1.4 Passing through the pole and with center on the initial line<br>2.1.5 Passing through the pole and the diameter through pole makingan angle $\alpha$ with initial line<br>2.2 Equation of chord, tangent and normal to the circle $r = 2acos\theta$<br>2.3 Polar equation of a conic in the form $\frac{l}{r} = 1 \pm ecos\theta$<br>2.4 Polar equation of a conic in the form $\frac{l}{r} = 1 \pm ecos(\theta - \alpha)$<br>2.5 chord, tangent and normal of conic | 08 |
| 3 | **Sphere:**<br>3.1 Equation of sphere in different form.<br>3.1.1 Centre – radius form.<br>3.1.2 General form.<br>3.1.3 Diameter form.<br>3.1.4 Intercept form.<br>3.2 Intersection of sphere with straight line and a plane.<br>3.3 Point and radical plane.<br>3.4 Tangent plane and condition of tangency.<br>3.5 Equation of circle.<br>3.6 Intersections of (i) two spheres (ii) sphere and plane.<br>3.7 Orthogonality of two spheres. | 09 |
| 4 | **Cone**<br>4.1 Definitions of cone, vertex, generators<br>4.2 Equation of a cone with vertex at a point $(X_1, Y_1, Z_1)$<br>4.3 Equation of a cone with vertex at origin | 07 |

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|---|---|---|
| | 4.4 Equation of a right circular cone<br>4.5 Equation of an enveloping cone<br>4.6 Equation of a tangent plane<br>4.7 Condition of tangency | |

**Recommended Books:**

1. Shanti Narayan: Analytical Solid Geometry, S. Chand and Company Ltd, New Delhi, 1998.

**Reference Books:**

1. S.P. Patankar, S.P. Thorat, Geometry, Nirali Prakashan.

2. Askwyth, E. H: The Analytical Geometry of the Conic Sections.

3. P. K. Jain and Khalil Ahmad, A Textbook of Analytical Geometry of Three Dimensions,Wiley Estern Ltd. 1999.

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**Course Code: - BMP24-203**

**MATHEMATICS PRACTICAL - II**

## Practical: Examples on

1. Exact differential equation.
2. Orthogonal trajectories.
3. D(y) = X, where X is of the form $e^{ax}$, $where$ a is constant $\sin(ax)$ and $\cos(ax)$
4. D(y) = X, where X is of the form $x^m$, m is positive integer, $e^{ax}$V, where V is function of X
5. Equation solvable for p.
6. Reducible to Clairaut's equation.
7. Translation.
8. Rotation.
9. Polar coordinates.
10. Equation of sphere in different form.

## SEMESTER II

## Paper Code: - OEMAT24-201

# Quantitative Aptitude for Competitive Exam –II (Credit 02)

**Course Outcomes (COs)**

**On completion of the course, the students will be able to:**

1. understand basic concepts polynomials, quadratic equations.
2. understand basic concepts of simple and compound interest.
3. interpret the bar, pie and line chart.
4. analyze the problems on heights, distances and speed.

| UNIT | Contents | Hours Allotted |
|---|---|---|
| **1** | 1.1 Algebra of polynomials<br>1.2 Quadratic equations<br>1.3 Partnership<br>1.4 Simple interest.<br>1.5 Compound interest | 08 |
| **2** | 2.1 Time, speed and distance<br>2.1 Time and work<br>2.3 Boat streams<br>2.4 Height and distance<br>2.5 Relative speed | 10 |
| **3** | 3.1 Work and wages<br>3.2 Pipes and cistern<br>3.3 Allegation<br>3.4 Problems on trains<br>3.5 Averages | 06 |
| **4** | 4.1 Tabulation<br>4.2 Line chart<br>4.3 Pie chart<br>4.4 Bar chart | 06 |

**Reference Books:**

1. R. S. Aggarwal, Quantitative Aptitude, S. Chand Publications.