

**Swami Ramanand Teerth Marathwada University, Nanded (M.S.).**  
**B.A./B.Sc. Third Year**  
**Syllabus (*Mathematics*)**  
**SEMESTER -V & VI**  
**Effective from June -2013**

**B.A./B.Sc. Third Year**  
**SEMESTER –V.**

*Note* : (1) Papers XIII (MT 301) and XIV (MT 302) are compulsory.  
(2) Choose either X V(A) OR XV (B), from the following papers.

**B.A./B.Sc. T.Y. Semester-V**  
**Paper XIII (MT 301): Metric Spaces**  
**(No. of periods: 60 Max.Marks:40+10=50)**

**Unit I:** Definitions and examples, open and closed sets.

**Unit II:** Convergence and completeness, Continuity and uniform continuity.

**Unit III:** Compactness, Connectedness.

**Text Book:** Mathematical Analysis, by S.C. Malik and Savita Arora. (second edition)

**Scope:** Chapter 19 complete.

Unit I: Art. 1, 2,2.1,2.2,2.3 (Theorem 1 only), 2.4,2.5,2.6,2.7(Definitions with illustrations and statements of theorems only).

Unit II: Art. 3, 4 (Theorem 16 statement only)

Unit III: Art 5 (Theorems 21statement), 5.1,5.2(Definitions with examples and statements of theorems 26 to 33 only)

Art 6. (up to theorem 38 and example 46 on connectedness).

**References:**

- 1) Real Analysis, by Somasundaram & Chaudhary.
- 2) Methods of Real Analysis, by R.Goldberg.Oxford & IBH Pub. Co.PVT Ltd
- 3) Elements of Real Analysis, By Shantinarayan & M.D. Raisinghania, (S. Chand. Co. Ltd )
- 4) Metric Spaces, by E. T. Copson, Cambridge University Press. Universal Book Co. New Delhi.
- 5) Lecturers on analysis, by T. M. Karade , Sonu Nilu Pub Nagpur .
- 6) Mathematical Analysis, by T. M. Apostol, Narosa Pub. House New Delhi.

**B.A/B.Sc. T.Y. Semester-V**  
**Paper XIV (MT 302): Linear Algebra.**

**(No. of periods: 60 Max.Marks:40+10=50)**

**Unit I:** Vector spaces: Elementary basic concepts of vector spaces, Linear independence and bases, Dual spaces.

**Unit II:** Inner product spaces, Fields: Extension fields (definitions only).

**Unit III:** Linear transformation: The algebra of linear transformations, Characteristic roots, Matrices.

**Text Book:** Topics in Algebra, by I.N. Herstein (2<sup>nd</sup> Edn.) John Wiley and Sons.

**Scope:** Unit I: Chap. 4: Art. 4.1,4.2,4.3  
Unit II: Chap. 4: Art. 4.4,  
Chap. 5: Art. 5.1.(Definitions only )  
Unit III: Chap. 6: Art. 6.1, 6.2 .6.3.

**References:**

- 1) A First course in Abstract Algebra ,by John B. Fraleigh.
- 2) Contemporary Abstract Algebra ,by Joseph A. Gallian.
- 3) Linear Algebra for under graduates, by S.R. Mangalgi and D.K. Daftari.
- 4) First Course in Linear Algebra, by P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul.
- 5) An Introduction to linear Algebra ,by V Krishnamurty , V P mainru, J.L. Arrora.
- 6) Linear Algebra, by L Smith, Springer-Verlag New York.
- 7) Matrix and Linear Algebra, by K b Datta, Prentic Hall of India Pvt. Ltd New Delhi, 2000.

**Choose either XV (A) or XV (B) from the following papers.**

**B.A/B.Sc. T.Y. Semester-V**

**Paper XV (A) (MT 303A): Operation Research**

**(No. of periods: 60 Max. Marks:40+10=50)**

**Unit I:** Linear programming (Mathematical formulation), Linear programming (Graphical), Graphical solution method, General linear programming problem, Canonical and standard forms of L.P.P, Simplex method.

**Unit II:** Linear programming (simplex method), Fundamental properties of solution, Computational procedure, Use of Artificial Variables, Degeneracy in Linear Programming, Solution of simultaneous linear equations, Inverting a matrix.

**Unit III:** Mathematical formulation of the problem, the assignment method, special cases, typical assignment problem, Traveling Salesman problem.

**Text Book:**

Operation Research, By Kanti Swarup, P.K. Gupta and Man Mohan. (Reprint 2005), S. Chand & Co.

**Scope:**

Unit I: Chapter-2: Articles 2.1, 2.2.

Chapt. 3: Art. 3.1 to 3.6.(Complete ).

Unit II: Chapter-4: Articles 4.1 to 4.7.(Complete ).

Unit III: Chapter-11: Articles 11.1 to 11.7.

**References:**

- (1) Introduction to Operation Research ,by Hiller and Lieberman.Tata Mc Graw Hill.
- (2) Operation Research an Introduction, by Hamdy A. Taha Pearson Pub.
- ( 3 ) Linear Programming Methods and applications), by Gass E. , Narosa Publishing House New Delhi .
- (4) Operation Research, by R K Gupta , Krishana Prakashan Media Ltd
- (5) Operation Research ,by Sharma S D , K Ramnath and Co. Meerut
- (6) Linear Programming ,by Manju Sharma , Ramprasad and Sons Agra -3
- (7) Operation Research (Theory and applications , Second Edition 2006), by J K Sharma, Macmilan India Ltd .

**B.A/B.Sc. T.Y. Semester-V**  
**Paper XV (B) (MT 303B): Mechanics-I**  
**(Statics)**  
**(No. of periods: 60 Max.Marks40+10=50)**

**Unit I: (Forces Acting on a particle)**

Definitions, Law of parallelogram of forces, Determination of magnitude and direction, Resultant of forces, Components and resolved parts, The Algebraic Sum of the resolved parts of two forces, To find magnitude and direction, Resultant of parallel forces.

**Unit II: (Equilibrium of Forces acting on a particle)**

Triangle Law of forces, Converse of triangle law of forces, Polygon of forces Lami's Theorem, Conditions of equilibrium of forces acting on a particle.

**Unit III (Forces acting on a rigid body)**

Introduction, Moment of force, The sum of vector moment of a system of forces, The Sum of the vector moments of two like parallel forces acting on a rigid body, Couples, Two couples acting in one plane upon a rigid body, Equivalent couples, The vector of the resultant couple of two couples, A System of forces acting upon a rigid body, Conditions of equilibrium of forces acting on a rigid body and Cartesian form, Conditions of equilibrium of coplanar forces acting on a rigid body.

**Text Book:** Mechanics and Differential Geometry, by V. Tulsani, Warhekar, N.N. Saste. (S. Chand and Co.).

**Scope:** Unit I: Chapter 1: Art. 1.1 to 1.17.  
Unit II: Chapter 2: Art. 2.1 to 2.5.  
Unit III: Chapter 3: Art. 3.1 to 3.12.

**References:**

- (1) Mechanics, by B.R. Thakur and G.P. Shrivastav.
- (2) Mechanics, by Shanti Narayan, S. Chand and Co.

## SEMESTER –VI.

**Note:** (1) Papers XVI (MT 304) and XVII (MT 305) are compulsory.  
(2) Choose either XVIII (A) or XVIII (B) from the following papers.

**B.A/B.Sc. T.Y. Semester-VI**  
**Paper XVI (MT 304): Numerical Analysis.**  
**(No. of periods: 60 Max.Marks:40+10= 50)**

### **Unit I: ( Differences, Operators, Interpolation with equal intervals)**

Introduction, Differences, Theorem, Factorial notation, The operator E, Properties of E and  $\Delta$ , the operators D and  $\nabla$ , Interpolation, Extrapolation, Interpolation with equal intervals, Newton- Gregory formula for forward and backward interpolation, Equidistant terms with one or more missing terms. Interpolation for unequal intervals of the arguments, Divided differences with unequal intervals, Divided differences, When two or more arguments are same, Properties of divided differences (Theorems 1, 2 only)

**Unit II:** Properties of divided differences(Theorems 3, 4 only), Newton's, Formula for unequal intervals, Lagrange's, Formula for unequal intervals, Central differences ( $\nabla, \delta, \sigma, \mu$ ), Interpolation formulae: Gauss, Bessel and Stirling's.

**Unit III:** Numerical differentiation, Introduction, Approximate Expressions for the derivative of a function, Unsymmetrical expressions for third order derivative, Numerical quadrature, Introduction, General quadrature formula, Trapezoidal, Simpson's one-third and three-eighth rules. Weddle's rule. Numerical solution of O.D.E., Introduction, equation of first order, Euler's method, Euler's modified method, Picard's method, Talyor series method.

**Text Book:** Finite Differences and Numerical Analysis. By H.C. Saxena.  
( S. Chand & Co. reprint 2001).

**Scope:** Chap. 1: Art. 1.1 to 1.3, 1.5.1,1.5.2,1.5.3, 1.6, 1.6.1, 1.6.2, 1.7 1.7.1, 1.8,  
1.8.1, 1.8.2, 1.8.3.

Chap. 2: A rt. 2.1,2.2, 2.3, 2.4.1.

Chap. 3: 3.1, 3.2, 3.3, 3.4, 3.5.

Chap. 5: Art. 5.1, 5. 2.53.

Chap. 6: Art. 6.1, 6.2, 6.3.1, 6.3.2, 6.3.3, 6.3.4

Chap. 15: Art. 15.1, 15.2.1,15.2.2, 15.2.3,15.2.4(a).

### **References**

1. S.S. Satry, "Introductory methods of Numerical Analysis" Prentice-Hall of India Private Ltd. (Second Edition) 1997.
2. E.V. Krishnamurthi & Sen. "Numerical Algorithm,"Affiliate East. West press. Private Limited 1986
3. M.K. Jain, SRK Iyengar, R.K. Jain, "Numerical methods for Scientific and Engineering computations." New Age International Limited Pub.

**B.A/B.Sc. T.Y. Semester-VI**  
**Paper XVII(MT 305): Partial Differential Equations.**  
**(No. of periods: 60 Max.Marks:40+10=50)**

**Unit I:** Definition of PDE, Order of PDE, Method of formatting PDE, Solution of equation by direct integration, Lagrange's linear equations, Working rule, Method of multipliers.

**Unit II:** Non-linear PDE in  $p$  &  $q$ , Charpit's method, Linear homogeneous PDE of  $n^{\text{th}}$  order with constant coefficients, Rules for finding C.F., Rules for finding P.I., Non-homogeneous linear equations, Monge's method.

**Unit III:** Introduction, Method of separation of variables, Equation of vibrating string, Solution of wave equation by D'Alembert's method, One-dimensional heat flow, Two-dimensional heat flow, Laplace equation in polar coordinates.

**Text Book:** Advanced Engineering Mathematics, By H.K. Dass.

**Scope:** Unit I: Art. 9.1 to 9.7.

Unit II: Art. 9.8 to 9.14.

Unit III: Art. 9.15 to 9.21

**References:**

- 1) Introductory course on Differential Equations, By D. A Murray, Orient Longman India 1967.
- 2) Differential Equations, By Raisinghania, S Chand Co.
- 3) Differential Equations by J. N. Sharma, Krishna Prakashan, Meerut.
- 4) Elements of Partial Differential Equation by I. N. Sneddon, McGraw Hill Co.
- 5) Theory and Problems of Differential Equations by Frank Ayres, McGraw Hill Co.
- 6) Lectures on Differential equations, by T.M. Karade, Sonu-Nilu Pub. Nagpur.
- 7) Advanced Engineering Mathematics, by Erwin Kreyszing, Johan Wiley & Sons New York.

**Choose either XVIII (A) or XVIII (B) from the following papers.**

**B.A/B.Sc. T.Y. Semester-VI**

**Paper XVIII (A) (MT 306A): Topology  
(No. of periods: 60 Max.Marks:40+10=50)**

**Unit I:** Fundamental concepts, Functions, Relations, The integers and the real numbers, Cartesian product , Finite Sets, Well-ordering theorem, Topological spaces, Basis for topology.

**Unit II:** The Ordered topology, The product topology, The subspace topology.

**Unit III:** Closed sets and limit points, Closure and interior of a set, Limit points, Continuity of a function, Definitions of product topology, Connected and compact spaces (definitions only).

**Text Book:** Topology A First Course, By James R. Munkres. Prentice Hall of India.

**Scope:** Unit I: Chap. 1: Art. 1.1 to 1.6, Art. 1.7 (statements of theorems), Art. 1.10

Chap. 2: Art. 2.1, 2.2.

Unit II: Chap. 2: Art. 2.3, 2.4, 2.5.

Unit III: Chap. 2: Art. 2.6, 2.7, 2.8 (definitions).

Chap. 3: Art. 3.1(theorems without proof 1.5, 1.6), 3.5 (definitions and examples).

**References:**

1. John Horvath, Topological Vector Spaces & Distribution, Addison-Wesely Publishing Company 1966.
2. F. Trèves, Topological Vector spaces, Distribution, Kernel, Academic Press, Inc., New York, 1967.
3. G. Kothe, Topological Vector spaces, Vol.1, Springer, New York, 1969.
4. R. Larsen, Functional Analysis, Marcel Dekker, Inc., New York, 1973.
5. Walter Rudein, Functional Analysis, TMH edition, 1974.

**B.A/B.Sc. T.Y. Semester-VI**  
**Paper XVIII (B) (MT 306B): Mechanics-II**  
**(Dynamics)**

**(No. of periods: 60 Max.Marks:40+10=50)**

**Unit I: (Kinematics and Dynamics of a particle in two dimensions)**

Introduction, Definitions, Expressions for velocity and acceleration, Components of velocity and acceleration, Tangent and unit vector, Rate of change of a unit vector moving in a plane, Curvature and principal normal, Tangential and normal components of velocity and acceleration, Angular speed and angular velocity, Angular acceleration, The radial and transverse directions, Find the radial and transverse components of velocity and accelerations .

**Unit II: (Kinetics of a Particle)**

Introduction, Newton's law of motion, Matter, Linear momentum, Impulsive force and its impulse, Unit of impulse, Conservation of linear momentum, Impact of two bodies, Work, Work done by a force, Unit of work, Power, Energy, Kinetic energy, Potential Energy Kinetic energy of particle of mass  $m$  moving with velocity, Definition of scalar and vector point function, Scalar and vector field, Field of force, Conservative field of force , Potential function.

**Unit III : (Motion of a Projectile and motion in resisting medium)**

Rectilinear motion, Motion under gravity, Projectile, Range on inclined plane projectile to pass through a given point  $(h, k)$ , The relation  $t_1.t_2 = \frac{2R}{g}$  .

**Text Book:** Mechanics and Differential Geometry, By V. Tulsani, Warhekar, N.N. Saste (S. Chand and Co.)

**Scope:** Unit I: Chap. 1: Art. 1.01 to 1.13.

Unit II: Chap. 2: Art. 2.01 to 2.25.

Unit III: Chap. 3: Art. 3.01 to 3.10 and 3.13, 3.14.

**References:**

(1) Mechanics, By B.R. Thakur and G.P. Shrivastav.

(2) Mechanics, By Shanti Narayan, S. Chand and Co.

(3) A text Book of Dynamics by J. N. Kapoor and J. D. Gupta , 5<sup>th</sup> Ed, Ramchand and Co. Delhi

(4) A Text Book of Dynamics by M ray, S Chand &Co.



**Paper XIX (MP 307): Practical Paper.(Annual pattern)**  
**(B.Sc. T.Y. SEMESTER –V & VI)**  
**(No. of periods 3 per Batch, per week, Max.Marks:100)**

**PRACTICALS USING MATHEMATICAL SOFTWARES.**

(Practical paper is only for **B.Sc.** students)

SECTION A: Solving problems in Algebra OR

SECTION A: Solving of Partial differential equations.

SECTION B: Solving problems in Mechanics/ Topology.

SECTION C: Solving problems in Numerical Analysis.

- NOTE:-** 1) No. of periods per week :**03**.per Batch of 20 students  
2) Examination pattern: **Yearly**  
3) Softwares: **Freeware, MATLAB**.etc.  
4) Minimum **20** practicals should be covered in Record book.

**Paper pattern for B A / B Sc III Year Mathematics**

**(For Semester v and vi ,Theory Pattern)**

**Faculty: of Arts / Science**

**Class: BA/ B Sc III year**

Time :- 2 Hrs

Marks 40

Q1 : Attempt any five of the following (2 Marks each )

- a)
- b)
- c)
- d)
- e)
- f)

Q2 Attempt anyTwo of the following (5- Marks each)

- a) Theory
- b )Theory or Problem
- c) Problem

Q3 Attempt anyTwo of the following (5- Marks each)

- a) Theory
- b )Theory or Problem
- c) Problem

Q4 Attempt anyTwo of the following (5- Marks each)

- a) Theory
- b ) Theory or Problem
- c) Problem