DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
AURANGABAD.

REVISED SYLLABUS

OF

B.A./ B.Sc. Mathematics
SECOND YEAR
[Optional]

Third & Fourth Semester

[Effective for - June, 2014-15]

Dr. Babasaheb Ambedkar University, Aurangabad

Revised Syllabus

For

B.Sc. (Second Year) MATHEMATICS

WITH EFFECT FROM JUNE – 2014

Semester Third :

1. Paper No. MAT – 301 : Number Theory
2. Paper No. MAT – 302 : Integral Transforms
3. Paper No. MAT – 303 : Mechanics - I

Semester Fourth :

1. Paper No. MAT – 401 : Numerical Methods
2. Paper No. MAT – 402 : Partial Differential Equations
3. Paper No. MAT – 403 : Mechanics - II

B.A. (Second Year) MATHEMATICS

WITH EFFECT FROM JUNE – 2014

Semester Third :

1. Paper No. MAT – 301 : Number Theory
2. Paper No. MAT – 302 : Integral Transforms

Semester Fourth :

1. Paper No. MAT – 401 : Numerical Methods
2. Paper No. MAT – 402 : Partial Differential Equations

(With Effect from June - 2014)

B. A. & B.Sc. (Second Year)(Third Semester)(Mathematics)

Paper No. MAT – 301: (Number Theory) **(Max. Marks : 50)**

1. Divisibility Theory in the Integers:
The Division Algorithm, The greatest common divisor, The Euclidean algorithm, The Diophantine equation $ax + by = c$.

2. Primes and their Distribution:
The Fundamental Theorem of Arithmetic

3. The Theory of Congruences:
Basic Properties of congruences, Linear congruences

4. Fermat's Theorem:
Fermat's Factorization Theorem, The little Theorem, Wilson's Theorem.

5. Number-Theoretic Functions:
The functions τ and σ, The Mobius inversion formula

6. Euler's Generalization of Fermat's Theorem:
Euler's Phi-function, Euler's Theorem, Some properties of Phi function

Recommended Text Book:
David M. Burton: *Elementary Number Theory*: (Second Edition) – 1987
Scope: Ch. (2) : Complete
Ch. (3) : Article 3.1
Ch. (4) : Articles 4.2, 4.4
Ch. (5) : Articles 5.2, 5.3, 5.4
Ch. (6) : Articles 6.1, 6.2, 6.3
Ch. (7) : Articles 7.2, 7.3

References:
1) Ivan Niven, Herbert Zuckerman: *An introduction to the theory of Numbers*: Wiley Eastern Ltd. New Delhi.
2) S. G. Telang: *Number theory*: Tata McGraw Hills, New Delhi.
3) C. Y. Hsiung: *Elementary theory of Numbers*: Allied publishers Ltd, New Delhi.
4) S. B. Malik: *Basic Number Theory*:
5) Hari Kishan: *Theory of Numbers*: Krishna Prakshan Meerut.
6) Ajay Chaudhari: *Introduction to theory of Numbers*: New Central book Agency(P) Ltd. Calcutta.
7) Ivan Niven, Herbert Zuckerman H. L. Montgomery: *An introduction to the theory of Numbers*: John Wiley and Sons New Delhi.
8) Pundir, Pundir: *Theory of Numbers* Pragati Prakashan Meerut.
9) G. E. Andrews: *Number Theory*: Hindustan Publishing Corporation, New Delhi.

B. A, & B.Sc. (Second Year)(Third Semester)(Mathematics)

Paper No. MAT – 302: (Integral Transforms) **(Max. Marks : 50)**

1. Beta and Gamma Functions:
Euler's Integrals - Beta and Gamma functions, Elementary properties of Gamma Function, Transformation of Gamma Function, Another form of Beta Function, Relation between beta and Gamma functions, Other Transformations. [1]

2. Laplace Transform:
Piece-wise or sectional continuity, function of exponential order, Function of class A, The transform concept, Laplace Transform, Notation, Some Standard results. [2]

3. Inverse Laplace Transform:
Definition, Null function, Uniqueness of inverse Laplace transform, partial fractions, Heaviside's expansion formula, the complex inversion formula

4. Applications to Differential Equations:
Differential Equation, Notations (Problems related to Ordinary Differential Equations only) [2]

5. Fourier Transform:
Infinite Fourier sine transform of $F(x)$, Finite Fourier cosine transform of $F(x)$, Infinite Fourier transform of $F(x)$, Relationship between Fourier transform and Laplace transform, Finite Fourier sine transform, Finite Fourier cosine transform, Fourier Integral Theorem [2]

Recommended Text Books:

1. J. N. Sharma, A. R. Vasishtha : *Real Analysis* : Krishna Prakashan media Pvt. Ltd. Merrut.
Scope : Ch. (14) : Art. 9, 10, 11, 12, 13, 14, 15, 16. 17
2. J. K. Goyal, K. P. Gupta : *Laplace And Fourier Transforms* : Pragati Prakashan, Meerut – Twentieth Edition 2007
Scope: Ch. (1) : Part – I : 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.5, 1.6,
Part – II : 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.5
Part – III : 1.0, 1.1.
Ch. (2) : Part – I : 2.0, 2.1, 2.2, 2.3,
Part- II : 2.0, 2.1

References:
1. B.J.Beerends, etl : ***Fourier and Laplace Transforms*** : Cambridge University Press – 2003.
2. Lokenath Bebnath, Dambaru Bhatta : ***Integral Transforms and their Applications*** : Chapman and Hall/CRC-2007.
3. E.J.Watson : ***Laplace Transforms and Applications*** : Van Nostrand Reinhold Company.
4. J. Williams : ***Laplace Transforms*** : George Allen and Unwin Ltd, London -1973.
5. Joe L. Schiff : ***The Laplace Transform:Theory and Applications*** : Springer-Verlag NewYork – 1999.
6. M.D.Raisinghania : ***Integral Transforms*** : S.chand and Company, New Delhi.
7. M.D.Raisinghania : ***Laplace and Fourier Transforms*** : S.chand and Company, New Delhi.
8. Goyal, Gupta: ***Integral Transforms***: Pragati Prakashan Meerut.

B.Sc. (Second Year) (Third Semester)(Mathematics)

Paper No. MAT – 303 : (MECHANICS – I) **(Max. Marks : 50)**

1. Forces acting on a Particle:

Particle, Rigid body, Force, The force as a vector, Equilibrium, An axiom for equilibrium of two forces, Statics, Resultant of forces, Law of parallelogram of forces, Principle of the transmissibility of force, Deductions, Resultant of forces $m \cdot \overrightarrow{OA}$ and $n \cdot \overrightarrow{OB}$, Components and Resolved parts, the algebraic sum of resolved parts of two forces, To find the magnitude and direction of the resultant of any number of coplanar forces acting at a point, Resultant of parallel forces.

2. Equilibrium of Forces acting on a Particle:

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

3. Forces acting on a Rigid Body:

Introduction, Moment of a force, Sum of vector moments of two like parallel forces, Couples, Conditions of equilibrium of forces acting on a rigid body, Trignometrical Theorems.

4. Centre of Gravity:

Centroid of weighted points, Centre of gravity, Centre of gravity of some uniform bodies.

Recommended Text Book:

V. Tulsani, T. V. Warhekar and N. N. Saste : *Mechanics and Differential Geometry:*
S. Chand and Co. (Pvt) LTd, New Delhi (Second Edition) – 1987

Scope: Part (I): Statics

Ch. (1) : Complete
Ch. (2) : Complete
Ch. (3) : Complete
Ch. (4) : Articles 4.1 to 4.7

References :

1. **B. R. Thakur, G. P. Shrivastava : *Mechanics* :** Ram Prasad and Sons, Agra – 3.
2. **M. L Khanna : *Dynamics* :** Kedarnath Ramnath Prakashan, Meerut.
3. **S. L. Loney : *An Elementary Tretise on Statics* :** A. I. T. B. S. Publishers and Distributors, New Delhi.

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B. A. & B. Sc. (Second Year)(Fourth Semester)(Mathematics)

Paper No. MAT – 401: (Numerical Methods) **(Max. Marks : 50)**

1. Solution of Algebraic and Transcendental Equations:

Introduction, Bisection method, Method of false position, Newton-Raphson method, Genralized Newton's method.

2. Interpolation:

Introduction, Finite differences, Forward differences, Backward differences, Central differences, Symbolic relations and separation of symbols, Differences of a polynomial, Newton's formulae for interpolation, Interpolation with unevenly spaced points, Lagrange's interpolation formula, Hermite's interpolation formula, Divided differences and their properties, Newton's general interpolation formula.

3. Curve Fitting and Approximations:

Introduction, Least-Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Approximations of functions, Chebyshev polynomials, Economization of power series.

4. Solution of Linear System of Equations:

Solution of Linear Systems-direct methods, Gaussian elimination method, Method of factorization, Solution of Linear Systems-iterative methods, The Eigenvalue problem, Householder's method, Eigenvalues of a symmetric tridiagonal matrix, The QR method

5. Numerical Solution of Ordinary Differential Equations:

Introduction, Solution by Taylor's series method, Picard's method of successive approximations, Euler's method, Runge Kutta methods

Recommended Text Book:
S. S. Sastry : ***Introductory Methods of Numerical Methods*** : Third Edition, Prentice Hall India, New Delhi.
Scope:
Chapter 2: Articles 2.1, 2.2, 2.4, 2.5, 2.5.1
Chapter 3: Articles 3.1, 3.3, 3.3.1 to 3.3.4, 3.5, 3.6, 3.9, 3.9.1, 3.9.3, 3.11, 3.11.1
Chapter 4: Articles 4.1, 4.2, 4.2.1, 4.2.2, 4.6, 4.6.1, 4.6.2
Chapter 6: Articles 6.3, 6.3.2, 6.3.4, 6.4, 6.5, 6.5.1 to 6.5.3
Chapter 7: Articles 7.1, 7.2, 7.3, 7.4, 7.5

Reference Books:
1). H.C.Saxena: Finite Differences and Numerical Analysis, S.Chand and Co.Pvt. Ltd, New Delhi
2). M.K.Jain, S.R.K. Iyengar, R.K.Jain: Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi.

B. A. & B. Sc. (Second Year)(Fourth Semester)(Mathematics)

Paper No. MAT – 402: (Partial Differential Equations) (Max. Marks : 50)

1. Prerequisites:

Derivation of a Partial Differential Equation by the elimination of arbitrary constants, Derivation of a Partial Differential Equation by the elimination of arbitrary functions,

2. Partial Differential Equations of Order One (Linear Equations) :

Definition of Partial Differential Equations, Lagrange's Linear Partial Differential Equation, Geometrical interpretation of the Lagrange's Linear Partial Differential Equation $Pp + Qq = R$.

3. Non-linear Partial Differential Equations of Order One:

Complete and Particular Integrals, General Integral, Singular Integral, Special method, Standard form I, Standard form II, Standard form III, Standard form IV, Charpit's method, Non-linear Partial Differential Equations of order one with three or more independent variables, Jacobi's method.

4. Linear Partial Differential Equations:

Definitions, Linear Homogeneous Partial Differential Equations with constant coefficients, Non-Homogeneous Linear Partial Differential Equations, Equations reducible to Linear form with constant coefficients.

5: Partial Differential Equations of Second Order:

Equations that can be integrated by inspection, Monge's method to solve the equation $Rr + Ss + Tt = V$, Method of Transformations (Canonical Forms)

Recommended Text Book:

P.P. Gupta, G.S.Malik, S.K.Mittal : *Partial Differential Equations* (Second Revised Edition – 2003) Pragati Prakashan, Meerut, ISBN-81-7556-518-7

Note: **Questions on Prerequisite may not be asked**
Scope:

Chapter 4: Articles 4.1, 4.4-4.5
Chapter 5: Complete Chapter (5.1-5.10)
Chapter 6: Articles 6.1- 6.4
Chapter 7: Artices 7.1, 7.2, 7.3, 7.5, 7.6

Reference Books:

1. **H.K.Dass : *Advanced Engineering Mathematics*** : S. Chand and Co. Ltd, New Delhi.
2. **N. Ch. S. N. Iyengar : *Differential Equations*** : Anmol Publications Pvt. Ltd. New Delhi.
3. **M. L. Khanna : *Partial Differential Equations*** : Kedarnath and Ramnath Prakahan, Meerut.

B.Sc. (Second Year)(Fourth Semester)(Mathematics)

Paper No. MAT – 403 : (Mechanics – II) **(Max. Marks : 50)**

1. Kinematics and Dynamics of a Particle in Two Dimensions:

Introduction, Definitions, Velocity and acceleration in terms of vector derivatives, Tangent and unit vector along the tangent, Rate of change of unit vector moving in a plane, Curvature principal normal, Tangential and normal components of velocity and acceleration, Angular speed and angular velocity, Radial and transverse components of velocity and acceleration, Areal speed and areal velocity.

2. Kinetics of a Particle:

Introduction, Newton's law of motion, Matter, Linear momentum, Angular momentum, An Impulsive force and its impulse, Conservation of linear momentum, Impact of two bodies, Work, Energy, Scalar point function, Vector point function, Field of force, Conservative field of force.

3. Motion of a Projectile and Motion in a Resisting Medium:

Rectilinear Motion, Motion under gravity, Projectile, Motion of projectile, Range on an inclined plane, Parabola of Safety, Projectile to pass through a given point, Motion in a resisting medium, Motion of a body moving under gravity and in a medium whose resistance varies as velocity.

4. Central Orbits:

Definitions, Areal velocity in Central Orbit, Differential equation of central orbit, Apses, Law of Force, Pedal equation of some curves

Recommended Text Book:

V. Tulsani, T. V. Warhekar and N. N. Saste : *Mechanics and Differential Geometry*:
S. Chand and Co. (Pvt) Ltd, New Delhi (Second Edition) – 1987
Scope: Part (I): Dynamics of a Particle
Ch. (1) : Complete
Ch. (2) : Complete
Ch. (3) : Complete
Ch. (4) : Articles 4.01 to 4.10

References :

1. B. R. Thakur, G. P. Shrivastava : *Mechanics* : Ram Prasad and Sons, Agra – 3.
2. M. L Khanna : *Statics* : Kedarnath Ramnath Prakashan, Meerut.
3. S. L. Loney : *An Elementary Tretise on Dynamics of a particle and of Rigid Bodies* : A. I. T. B. S. Publishers and Distributors, New Delhi.

Dr. B. R. Sontakke
Chairman,
B. O. S. in Mathematics