DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Syllabus of

B.Sc. III Year

Mathematics

Semester-V & VI

[Effective from 2011-12 & onwards]

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

Paper No. MAT – 501 : (Analysis – I) **Marks: (30 + 20)**

1. Sequences of real Numbers:
Definition of sequences and subsequences, Limit of a sequence, Convergent sequence, Divergent Sequence, Bounded sequences, Monotone Sequences, Operations on Convergent Sequences, Operations on divergent sequences, Limit superior and limit inferior, Cauchy Sequences [1]

2. Series of Real Numbers:
Convergence and divergence, Series with non-negative terms, Alternating series, Conditional convergence and absolute convergence [1]

3. Limits in Metric Spaces
Metric spaces, Limits in Metric spaces [1]

4. Continuous functions on Metric Spaces:
Functions continuous on metric spaces, Open sets, Closed sets [1]

Recommended Books:

[1] ***Methods of Real Analysis***: R. R. Goldberg, Oxford and IBH Publishing Co. Pvt. Ltd Dew Delhi.

Scope:

Ch. 2: 2.1 (*A, B, C, D*), 2.2 (*A, B*), 2.3 (*A, B, C, D*), 2.4 (*A, B, C*), 2.5 (*A, B*), 2.6(*A, B, C, D*), 2.7 (*A, B, C, D, E, F, G, H, I*), 2.8 (*A, B, C, D*), 2.9(*A, B, C, D, E, F, G, H, I, K, M*), 2.10 (*A, B, C, D*)

Ch. 3: 3.1(*A, B, C, D*), 3.2 (*A, B, C, E*), 3.3 (*A, B*), 3.4 (*A, B, C*)

Ch. 4: 4.2 (*A, B, C*), 4.3 (*A, C, D*)

Ch. 5: 5.3 (*A, B, C, D, E, F, G, H*), 5.4 (*A, B, C, D, E, F, G*), 5.5 (*A, B, C, D, E, F, G, H, H, I, J, L, M,*)

Paper No. MAT – 502 : (Abstract Algebra – I) Marks: (30 + 20)

Group Theory:
Definition of a group, Some examples of groups, Some preliminary Lemmas, Subgroups, A counting principle, Normal and Quotient groups, Homomorphisms, Automorphisms, Another counting principle [1]

Recommended Books:
[1] ***Topics in Algebra***: I. N. Herstein, Willey Eastern Pvt. Ltd Dew Delhi.
Scope:
Ch. 2: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.11 (Theorem 2.11.3 and Lemma 2.11.3 are without proof)

Reference Books:

1) ***Modern Algebra:*** **A. R. Vasishtha,** ***Krishna Prakashan Media Pvt. Ltd. Meerut.***
2) ***Modern Algebra:*** **M. L. Khanna,** ***Jai Prakash Nath and Co. Meerut.***
3) ***A course in Abstract Algebra:*** **Vijay K. Khanna and S. K. Bhambri,** ***Vikas Publishing House Pvt. Ltd. New Delhi.***
4) ***Modern Algebra:*** **Surjeet Singh and Qazi Zameeruddin,** ***Vikas Publishing House Pvt. Ltd. New Delhi.***
5) ***Advanced Abstract Algebra:*** **Bhupendra Singh,** ***Pragati Prakashan Meerut.***
6) ***A Text book of Modern Abstract Algebra:*** **Shanti Narayan and Sat Pal,** ***S. Chand and Co. Ltd. New Delhi.***

Optional Paper any One

Paper No. MAT – 503 : (Mathematical Statistics) Marks: (30 + 20)

1) Frequency Distribution

Construction and Graphical Representation of Frequency distribution, Histograms, Frequency Polygon, Frequency cummulative, Frequency curve, Cummulative frequency curve

2) Measures of Central Tendency:

Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median and Quartiles, Properties of arithmetic mean

3) Measures of Dispersion:

Various measures of dispersions, coefficient of Dispersion and variations, Moments, Skewness and kurtosis

4) Curve fitting and principle of least square:

What is curve fitting, Principles of least squares, Fitting a data to a line and to a parabola

Recommended Book:

Fundamentals of Mathematical Statistics: S. G. Gupta and V. K. Kapoor, Sultan Chand and Co. New Delhi (9 th Edition).

Scope:

Ch. 2: 2.1, 2.1.1, 2.1, 2.2.1, 2.2.2, 2.3, 2.4, 2.5, 2.5.1, 2.5.2, 2.5.3, 2.6, 2.6.1, 2.6.2, 2.7, 2.7.1, 2.7.2, 2.8, 2.8.1, 2.9, 2.9.1, 2.11

Ch. 3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.7.1, 3.7.2, 3.7.3, 3.8, 3.8.1, 3.9, 3.9.1, 3.10

Ch. 9: 9.1, 9.1.1, 9.1.2, 9.1.3, 9.1.4

Paper No. MAT – 504 : (Spherical Trigonometry) Marks: (30 + 20)

1) Introduction:

Section of a sphere, Great and small circles, number of great circles through two points, shortest arc joining two points, Axis and poles, properties of poles, Spherical radius, Angular distance, Two great circles bisects each other, Secondaries, Length of the arc of a small circle, Spherical triangles, Angles of a spherical triangle cannot be greater than two right angles, Some properties about spherical triangle [1]

2) Fundamental Formulae:

Cosine formula, General proof of the cosine formula, Supplimental cosine formula, Sine formula, Formulae for half angles, Formulae for half sides, Sine-cosine formula, Supplimental sine-cosine formula, Cotangent formulae, Napier′s analogies, Delambre′ analogies [1]

3) Right angled triangles:

Right angled triangles, Napier′s rule to write all formulae of right angled triangle, Lune, Area of spherical triangle, Cagnoli′s theorem, L′Huilier′s theorem [1]

Recommended Books:

[1] ***Spherical Trignometry and Spherical Astronomy***: G .S. Malik and H. D. Pandey, Pragati Prakashan Meerut.

Scope: Chapter 1 (Complete), Chapter 2 (Complete) Chapter 3 (Complete)

Reference Books:

(1) ***Spherical Astronomy***: S. K. Sharma, R. K. Gupta and Dhirendra Kumar, *Krishna Prakashan Mandir, Meerut.*

(2) ***Spherical Trignometry***: M.L. Khanna, *Jai Prakash NAth and Co. Meerut.*

(3) ***Spherical Trignometry***: P.N. Chatterji, *Rajhans Prakashan Mandir, Meerut.*

Paper No. MAT – 505 : (Ordinary Differential Equations - I) Marks: (30 + 20)

1) Preliminaries:

Introduction, Complex numbers, functions, Polynomials, complex series and the exponential function, Determinants. [1]

2) Linear equations of the first order:

Introduction, differential equations, problems associated with differential equations, Linear equations of the first order, The equation $y' + ay = 0$, The equation $y' + ay = b(x)$ [1]

3) Linear equations with constant coefficients:

Introduction, The second order homogeneous equation, Initial value Problems for second order equations, Linear Dependence and Independence, A formula for the Wronskian, The non-homogeneous equation of order two, The homogeneous equation of order n. [1]

Recommended Books:

[1] ***An Introduction to Ordinary Differential Equations***: E. A. Coddington, Prentice Hall of India, New Dehli.

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Scope: Chapter 0 (Complete),
Chapter 1 : Art. 1, 2, 3, 4, 5, 6
Chapter 2 : Art. 1, 2, 3, 4, 5, 6, 7, 8.

References:

1) *Theory of Ordinary Differential Equations* : E. A. Coddington and Levinson, Norman. McGraw Hill NewYork 1955.
2) *An Ordinary Differential Equations* : Hurewitz Witold. McGraw Hill NewYork 1955.

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

Paper No. MAT – 601 : (Analysis – II) **Marks: (30 + 20)**

1. Connectedness, Completeness and Compactness:
More about open sets, Connected sets, Bounded sets and Totally bounded sets, Complete metric spaces, Compact metric spaces, continuous functions on compact metric spaces, Uniform continuity [1]

2. Calculus:
Sets of measure zero, Definition of the Riemann Integral, Existence of the Riemann integral, Properties of the Riemann Integral, Fundamental Theorem of Calculus [1]

3. Fourier Series:
Introduction [2]

Recommended Books:

[1] ***Methods of Real Analysis***: R. R. Goldberg, Oxford and IBH Publishing Co. Pvt. Ltd Dew Delhi.

Scope:

Ch. 6: 6.1 (*A, B*), 6.2 (*A, B*), 6.3 (*A, B, C, D, E*), 6.4 (*A, B, C, D, E, F*), 6.5(*A, B, C, D, E*), 6.6 (*A, B, C, D*), 6.8 (*A, B, C, D, E*)

Ch. 7: 7.1 (*A, B, C, D*), 7.2 (*A, B, C, D, E, F, G*), 7.3 (Theorem and Lemma without Proof), 7.4 (*A, B, C, D, E, F*), 7.8 (*A, B, C, D, E, F, G*)

[2] ***A First Course in Mathematical Analysis***: D. Somsundaram, B. Chaudhary, Narosa Publishing House.

Scope:

Ch. 10: 10.1

Paper No. MAT – 602 : (Abstract Algebra – II) **Marks: (30 + 20)**

Ring Theory:

Definition and examples of rings, Some special classes of rings, Homomorphisms, Ideals and Quotient rings, More ideals and Quotient rings, Euclidean rings, Polynomial Rings. [1]

Recommended Books:
[1] ***Topics in Algebra***: I. N. Herstein, Willey Eastern Pvt. Ltd Dew Delhi.
Scope:
Ch. 3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.7, 3.9 (Lemmas 3.9.5, 3.9.6 are without proof)

Reference Books:

1) ***Modern Algebra:*** **A. R. Vasishtha,** ***Krishna Prakashan Media Pvt. Ltd. Meerut.***
2) ***Modern Algebra:*** **M. L. Khanna,** ***Jai Prakash Nath and Co. Meerut.***
3) ***A course in Abstract Algebra:*** **Vijay K. Khanna and S. K. Bhambri,** ***Vikas Publishing House Pvt. Ltd. New Delhi.***
4) ***Modern Algebra:*** **Surjeet Singh and Qazi Zameeruddin,** ***Vikas Publishing House Pvt. Ltd. New Delhi.***
5) ***Advanced Abstract Algebra:*** **Bhupendra Singh,** ***Pragati Prakashan Meerut.***
6) ***A Text book of Modern Abstract Algebra:*** **Shanti Narayan and Sat Pal,** ***S. Chand and Co. Ltd. New Delhi.***

Optional Paper any One

Paper No. MAT – 603 : (Mathematical Statistics – II) **Marks: (30 + 20)**

1) Theory of Probability:
Deterministic and non-deterministic experiments, Trial and events, Mathematical and Statistical definition of Probability, Axiomatic approach to a probability, Laws of addition and multiplication of probability (Extensions without proof)

2) Random Variables:
Discrete and continuous random variables, Probability density functions, Distribution function and its properties

3) Mathematical Expectations:
Definition, Addition and multiplication theorem on mathematical expectation, Covariance, Expectation and Variance of linear combination of random variables, Moment generating function, Cumulants

4) Probability Distributions:
Binomial Distribution. Poisson distribution, Uniform distribution, Normal and Exponential distribution

Recommended Book:
Fundamentals of Mathematical Statistics: S. G. Gupta and V. K. Kapoor, Sultan Chand and Co. New Delhi (9 th Edition).

Scope:
Ch. 4: 4.1, 4.3, 4.3.1, 4.3.2, 4.6, 4.6.1 (Theorems 4. 2 to 4.6), 4.6.2, 4.7(Theorems 4.9 t0 4. 12), 4.7.3 (Theorems 4.13 to 4.17)
Ch. 5: 5.1 (Theorems without proof), 5.2, 5.2.1, 5.3, 5.3.1, 5.4, 5.4.2, 5.4.3
Ch. 6: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.6.1, 6.7, 6.10, 6.10.1, 6.10.2, 6.11, 6.11.1, 6.11.2
Ch. 7: 7.2, 7.2.1, 7.2.2, 7.2.6, 7.2.7, 7.2.9, 7.2.10, 7.3, 7.3.1, 7.3.2, 7.3.4, 7.3.5, 7.3.7, 7.3.8
Ch. 8: 8.1, 8.1.1, 8.1.2, 8.2, 8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7, 8.6, 8.6.1

B.Sc. (Third Year) *Sixth Semester (Mathematics)*

Paper No. MAT – 604 : (Spherical Astronomy) **Marks: (30 + 20)**

1) Refraction:
Refraction, laws of refraction, refraction of a star near zenith, Cassini's hypothesis, Differential equation for refraction, Simpsion' hypothesis, Bradley's formula, Effect of refraction on sun-rise or sunset, Effect of refraction on right ascension and declination, Refraction in any direction, Effect of refraction in the distance of two neighbouring stars, Effect of refraction on the shape of the disc of the sun [1]

2) Time:
Sidereal time, Tropical year, The mean sun, the equation of time, To prove the equation of the time vanishes four times in a year, Seasons, Lengths of seasons [1]

3) Kepler's laws of planetary motion:
Kepler's laws, Deduction of Kepler's laws from Newton's law of gravitation, Definitions, To express the true anomaly in terms of eccentric anomaly, Kepler's equation Kepler's problem, To express thr true anomaly in terms of mean anomaly, Lembert theorem, Euler's Theorem [1]

Recommended Books:
[1] ***Spherical Astronomy***: S. K. Sharma, R. K. Gupta and Dhirendra Kumar, *Krishna Prakashan Mandir, Meerut.*
Scope: Chapter 3 (Complete), Chapter 4 (Complete) Chapter 9 (Complete)

Reference Books:
(1) ***Spherical Trignometry and Spherical Astronomy***: G .S. Malik and H. D. Pandey, *Pragati Prakashan Meerut.*
(2) ***Astronomy*** **:** M.L. Khanna, *Jai Prakash NAth and Co. Meerut.*
(3) ***Spherical Astronomy***: P.N. Chatterji, *Rajhans Prakashan Mandir, Meerut.*

B.Sc. (Third Year) *Sixth Semester (Mathematics)*

Paper No. MAT – 605:(Ordinary Differential Equations - II) Marks: (30 + 20)

1) Linear equations with variable coefficients:
Introduction, Initial Value Problems for the homogeneous equation, Solutions of the homogeneous equation. The Wronskian and linear independence, Reduction of the order of a homogeneous equation, The non-homogeneous equation, Homogeneous equations with analytic Coefficients, The Legendre Equation. [1]

2) Linear equations with Regular singular Points:
Introduction, The Euler Equation, Second order equations with regular singular points (An example), Second order equations with regular singular points, The Bessel equation, The Bessel equation (continued), Regular singular points at infinity. [1]

Recommended Books:
[1] ***An Introduction to Ordinary Differential Equations***: E. A. Coddington, Prentice Hall of India, New Dehli.

Scope: Chapter 3 : Art. 1, 2, 3, 4, 5, 6, 7, 8
Chapter 4 : Art. 1, 2, 3, 4, 7, 8.

Bhosale H.S.
Chairman
BOS. in Mathematics.

B.Sc. (Third Year) 15 *Sixth Semester (Mathematics)*