UNIVERSITY OF PUNE, PUNE 411007.

BOARD OF STUDIES IN MATHEMATICS

SYLLABUS

F.Y.B.Sc (MATHEMATICS)
PAPER – 1
ALGEBRA AND GEOMETRY

FIRST TERM

1) Sets **(4 Lectures)**

1.1 Power set of a set, Product of two sets.
1.2 Equivalence relations, partitions of sets, Equivalence classes**.**

2) Functions **(4 Lectures)**

2.1 Definition of a function. Domain, co-domain and the range of a function. Review of injective, surjective and bijective functions, Composition of functions. Invertible functions and the inverse of a function.
2.2 Binary operations.

3) Integers **(14 Lectures)**

3.1 Well Ordering Property (W.O.P) for N.
3.2 Divisibility in Z: Definition and elementary properties. Division Algorithm, G.C.D.and L.C.M of two integers. Basic properties of G.C.D. including G.C.D. for any two integers a and b if it exists, is unique, and can be expressed as ua+vb. Euclidean Algorithm.
3.3 Primes. Euclid's Lemma, Unique Factorization Theorem.
3.4 Congruences: Definition and elementary properties. The set Zn. Fermat's Theorem. Euler phi-function. Addition modulo n , multiplication modulo n and its properties.

4) Complex Numbers **(10 Lectures)**

4.1 Addition and multiplication of complex numbers, Modulus and amplitude of a complex number. Real and imaginary parts and the conjugate of a complex number. Geometric representation of the sum, difference, product and quotient of two complex numbers as well as of the modulus, amplitude and the conjugate of a complex number.
4.2 De-Moivre's Theorem. Roots of unity. Solutions of the equation $w^n = z$.

5) Polynomials (4 Lectures)

5.1) i) The set Q[x] of polynomials in one variable with rational coefficients.
Division Algorithm (without proof). G.C.D of two polynomials(without proof).
ii)Remainder Theorem, Factor Theorem(with proof).
iii)Relation between the roots and the coefficients of a polynomial. Examples.

SECOND TERM

6) Analytical Geometry of Two Dimensions (8 Lectures)

6.1) Change of axes: translation and rotation.
6.2) Conic Sections: General equation of second degree in two variables. Reduction to standard form. Centre of conic. Nature of conic.

7) Analytical Geometry of Three Dimensions (12 Lectures)

7.1) Review of Co-ordinates in 3-space. Direction cosines and direction ratios.
7.2) Every linear equation in x.y,and z represents a plane.

7.3) Equations of coordinate planes. Normal form of equation of a plane.Plane passing through three non-collinear points. Intercept form of equation of a plane. Distance of a point from a plane. Distance between parallel planes.
7.4) Systems of planes. Bisector planes.
7.5) Equations of a line in various forms. Symmetric and unsymmetric forms of the equations of a line. Line passing through two points.
7.6) Angle between a line and a plane. Perpendicular distance of a point from a plane. Condition for two lines to be coplanar.

7.3) Skew lines and shortest distance between skew lines.

8) Sphere: (6 Lectures)

8.1) Equation of a sphere in different forms, plane section of a sphere, Equation of a circle. Sphere through a given circle. Intersection of a sphere and a line. Equation of tangent plane to standard sphere and general sphere.

9) **System of Linear Equations : (10 lectures)**

9.1) System of m linear equations in n unknowns; Homogeneous systems, Non homogeneous system, Matrix form of System of Equations

9.2) Echelon form; row reduced echelon form of a matrix

9.3) Definition of rank of a matrix. Examples.

9.4) Gauss Elimination Method.

9.5) Consistency of a system of non homogeneous equations; Condition of consistency i.e. for $AX = B$, $\rho[A,B] = \rho[A]$ (without proof).

TEXT BOOKS :

1) Complex Variables and Applications : Ruel. V.Churchill; McGraw Hill Co.
2) Elementary Number Theory : David Burton ; Tata McGraw Hill (Walter Rudin Series), Indian Edition.
3) Matrices : Shanti Narayan; S.Chand & Co. N.Delhi
4) Analytical Geometry of Two and Three Dimensions : Qazi Zameeruddin; Narosa Publ..

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F.Y.B.Sc (MATHEMATICS)
PAPER II
CALCULUS

FIRST TERM

1. The Real Numbers : [8 lectures

i. Algebraic and order properties of R
ii. Absolute Value and the Real Line
iii. The Completeness Property of R
iv. Applications of the Supremum Property

2. Sequences of Real Numbers : [20 lectures

i. Sequences and their Limits
ii. Limit Theorems
iii. Monotone Sequences
iv. Subsequences and Bolzano - Weierstrass Theorem
v. The Cauchy criterion
vi. Properly divergent sequences
vii. Introduction to infinite series

3. Limits [8 lectures

i. Limits of Functions
ii. Limit Theorem
iii. Some Extensions of Limit Concepts

SECOND TERM

4 Continuous Functions

[16 lectures

i. Continuous Functions
ii. Combinations of Continuous Functions
iii. Continuous functions on intervals

5 Differentiation [20

i. The Derivative
ii. The Mean Value Theorem
iii. L'Hospital's Rules
iv. Successive Differentiation
v. Taylor's Theorem

Text Books :

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002
   Sections :
   First Term : 2.1, 2.2, 2.3, 2.4, 3.1 to 3.7 , 4.1, 4.2, 4.3
   Second Term : 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4

2. Differential Calculus, Shantinarayan, 7^{th} Edition, S. Chand and Co. Publication
   Chapter 5

Reference Books :

1. A Course in Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer 2006.
2. Principles of Mathematical Analysis, W. Rudin, Third Edition, McGraw Hill, 1976

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BOARD OF STUDIES IN MATHEMATICS

F.Y.B.Sc (MATHEMATICS)
PAPER – III
PRACTICAL PAPER

Modalities For Conducting The Practical and The Practical Examination

1) There will be four Practical slots (each of 45 minutes) per week, two slots for Paper I and two for Paper II. (24 Practical slots for Paper I and 24 practical slots for Paper II per term in any one term) **OR** one 3 hour Practical session for each batch of 20 students per week

2) A question bank consisting of 100 problems in all for the whole year, distributed in four Sections: 50 questions for each term (25 questions on Paper I and 25 on Paper II) will be the course work for this paper. Question Bank will be prepared by a Sub-Committee to be appointed by the Board of Studies in Mathematics. Question Bank shall be ready by first week of June, 2008.

3) The College will conduct the written Practical Examination of 80 marks at least 15 days before the commencement of the Main Theory Examination. There will be no external examiner. The written practical exam will be of the duration of 3 hours and the question paper will be as follows:
   Q1. (a) Any 1 out of 2 worth 10 marks on Paper I(first term).
   (b) Any 1 out of 2 worth 10 marks on Paper II.(first term).

   Q2. Any 4 out of 5 each of 5 marks on Paper I.

   Q3. Any 4 out of 5 each of 5 marks on Paper II.

   Q4. (a) Any 1 out of 2 of 10 marks on Paper I(second term).
   (b) Any 1 out of 2 worth 10 marks on Paper II(second term).

   In Q2 and Q3, there will be either 2 questions from first term and 3 questions from the second term or vice versa.

4) Each student will maintain a journal to be provided by the College at cost. The student will submit certified journal at the time of the Practical Examination. There will be 20 marks for internal assessment, which will include marks for journal and attendance.

5) 60 percent of the questions for the written practical examination will be exclusively set from the Question Bank provided. **Questions from the Question Bank (meant for practical course) should NOT be asked in the University Theory Examinations.**

6) The Question Bank shall be changed once every three years.

7) A Guideline as to the number of slots per week to be allotted for each topic per paper is as under:-

N.B. :- In each term 12 practicals will be held including 2 revision practicals. Each practical can either be conducted in one session of 3 hours or it can be spread out over 4 slots of 45 mins each per week. Hence the total number of slots per term for the practicals is 48.

FIRST TERM

Paper-I: Algebra and Geometry

Sr.No.	Topic	
1	Sets	02
2	Functions	02
3	Integers	06
4	Complex Numbers	06
5	Polynomials	04
6	Revision	04
	Total	24

Paper-II: Calculus.

Sr.No	Topic	
1	The Real Numbers	04
2	Sequences of Real Numbers	06
3	Limits	04
4	Continuous Functions	06
5	Revision	04
	Total	24

SECOND TERM

Paper-I: Algebra and Geometry

Sr.No	Topic	
1	Geometry of Two Dimensions	06
2	Geometry of three dimensions	06
3	Sphere	02
4	System of linear equations	06
5	Revision	04
	Total	24

Paper-II: Calculus.

Sr.No	Topic	
1	Continuous Functions on intervals	08
2	Differentiation	12
3	Revision	04
	Total	24

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