

UNIVERSITY OF MUMBAI



Syllabus for: F. Y. B. Sc.

Program: B.Sc.

**Course: Interdisciplinary Science
(Mathematics)**

(Credit Based Semester and Grading
System with effect from the Academic year
2014–2015)

Preamble

As per the perspective plan of the University which was approved by the Management Council on 11th September 2013 & subsequently by the Academic Council on 19th September 2013, University of Mumbai is going to offer B.Sc. Interdisciplinary programme under the category of Innovative programmes from the academic year 2014-2015. The main objective of this course is to make the learner well versed with all science disciplines as science graduate so that he/she can have scope in schools, banks or any offices as well as they can pursue post graduation in the major subject.

The Rational:

The basic thoughts and understanding in the programme of BSc with interdisciplinary science is, many or around 60 % students after their graduation leave higher education and opt for jobs. These jobs are in Government offices, Municipal Corporations, private companies or, in schools as teachers. They are absorbed as science graduates. Even when the students opt for management carriers they are considered as science graduates at entry level. Thus the specialization or the major subject does not have relevance unless the students want to pursue the carrier in the field of research or higher education. Similarly those who enter in jobs of teachers find it difficult to teach other science subjects as required, than the subject of specialization, because they are not exposed to those branches of science.

With all these requirements of job market University has decided to introduce the graduation course in science as BSc interdisciplinary science. In this a learner can take two subjects from science discipline at first year level, from among these one subject can be selected at Second Year and the same will be continued as major subject along with applied component for final year B. Sc. The learner will earn 70 credits as explained in this subject like the existing system.

In first year instead of the third subject the learner can opt any subject from the prescribed modules and as per the availability in the college / institute where admitted. These modules can be called as interdisciplinary modules. At the second year level instead of the second minor subject the learner can opt the modules from the interdisciplinary modules. The foundation course is also modified for interdisciplinary science which includes topics like Law, Economics, Sociology, Political Science etc.

Thus the learner will earn 70 credits in the major subject as obtained by any student in current traditional method. The remaining 50 credits can be earned from the interdisciplinary courses. The modules of interdisciplinary courses can be from science branches or arts / commerce / law / fine arts branches.

**Interdisciplinary Science (Mathematics)
Credit Based Semester and Grading System
First Year B. Sc. 2014-2015**

MODULE I

Mathematics I				
Course Code	UNIT	TOPICS	Credits	L/ Week
USIDMT101	I	Set theory, Relations and Functions	3	3
	II	Complex numbers		
	III	Matrices and System of Linear Equations		

MODULE II

Mathematics II				
Course Code	UNIT	TOPICS	Credits	L/ Week
USIDMT201	I	Limits and Continuity	3	3
	II	Differentiation		
	III	Integration		

Teaching Pattern:

1. Three lectures per week per course.
2. One Tutorial per week per batch per course (The batches to be formed as prescribed by the University).
3. One assignment per course or one project.

MODULE I

USIDMT101: Mathematics I

Unit I: Set Theory, Relation and Functions (15 Lectures):

Set, subset, union and intersection of two sets, empty set, universal set, complement of a set, De Morgan's laws, Cartesian product of two sets.

Relations, binary relation, equivalence relations, equivalence classes, properties such as two equivalence classes are either identical or disjoint, Definition of partition, examples.

Definition of function, domain, codomain and range of a function, composite functions, examples, Direct image $f(A)$ and inverse image $f^{-1}(A)$ of a function f , Injective, surjective, bijective functions, Composite of injective, surjective,

bijjective functions, Invertible functions, Bijjective functions are invertible and conversely, Examples of functions including constant, identity, examples,

Unit II. Complex numbers (15 Lectures)

Definition; Fundamental operations with complex numbers; Modulus and argument of complex numbers; Geometrical representation of complex numbers; Polar form of complex numbers; De Moivre's theorem; Roots of complex numbers; Euler's formula; Polynomial equations; The n th roots of unity; Vector representation of complex numbers.

.Unit III: Matrices and System of Linear Equations (15 Lectures)

Matrices, Echelon and Reduced echelon form of a matrix, Reduction of matrix to its echelon form, Definition of rank of a matrix by using echelon form.

System of linear equations, Matrix form of system of linear equations, Homogeneous and non-homogeneous system of linear equations, Gauss Elimination, Consistency of a system of linear equations, condition of consistency (without proof).

Eigen values, Eigen vectors, characteristic equation of a matrix of order up to 3×3 , Statement of Cayley Hamilton theorems and its use to find the inverse of a matrix.

Recommended Books:

1. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.
2. H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Edition, Wiley, 1994.
3. S. Ponnuswamy, H. Silverman, Complex Variables with applications, Birkhauser, 2007.

Reference Books

1. Robert R. Stoll: Set theory and logic, Freeman & Co.
3. 4. N. S. Gopalkrishnan, University Algebra, New Age International Ltd.
3. K. B. Datta, Matrix and Linear Algebra, PHI, New Delhi, 2000.

Assignments (Tutorials)

1. Complement, Cartesian product of sets, De-Morgan's laws.
2. Equivalence relation.
3. Functions (direct image and inverse image). Injective, surjective, bijective functions, finding inverses of bijective functions.
4. Polar form of complex numbers; De Moivre's theorem; Roots of complex Numbers; Euler's formula, n th roots of unity.
5. Solving system $AX = B$ by Gauss elimination.
6. Verification of Cayley Hamilton theorems and its use to find the inverse of a matrix.

MODULE II

USIDMT201: Mathematics II

Unit: Limits and Continuity (15 Lectures)

- Definition of Limit
- Properties of Limit
- Limits of some elementary functions
- Limits at infinity and infinite limits
- Some important classes of functions and their graphs
- Power function, logarithmic function, trigonometric and inverse trigonometric functions
- Definition Continuity
- Properties of continuous function
- Continuity of some elementary functions

Unit II: Differentiation (15 Lectures)

- Definition of derivative
- Geometrical and physical interpretation
- Some general theorems on differentiation (without proof)
- Derivative of some elementary functions
- Derivative of composite and inverse functions
- Logarithmic differentiation
- Successive differentiation
- Standard results of Successive differentiation
- Leibnitz theorem (without proof)
- Application of differentiation to maxima and minima

Unit III: Integration (15 Lectures)

- Definition and standard elementary integrals
- Methods of integration
- Integration of the type $\int \sqrt{a^2 - x^2} dx$, $\int \sqrt{a^2 + x^2} dx$, $\int \sqrt{x^2 - a^2} dx$

$$\int \frac{1}{\sqrt{a^2 - x^2}} dx, \int \frac{1}{\sqrt{a^2 + x^2}} dx, \int \frac{1}{\sqrt{x^2 - a^2}} dx$$

- Integration by parts
- Integration of the type $\int e^{ax} \cos(bx+c) dx$, $\int e^{ax} \sin(bx+c) dx$
- Definite Integrals
- Application of integration to area of a region bounded by a curve, X-axis and two co-ordinates

Recommended book:

1. Differential Calculus by Shanti Narayan Publication S.Chand and Company Ltd. (For Unit I and II)
2. Integral Calculus by Shanti Narayan Publication S.Chand and Company Ltd. (For Unit III)

Reference Book:

1. Calculus by Anton, Bivens and Davis Publication Wiley India edition.

Assignments (Tutorials)

1. Calculating limits of Power function, logarithmic function, trigonometric and inverse trigonometric functions etc.
2. Discussion of continuity of function.
3. Differentiation of composite and inverse function.
4. Higher order derivatives, nth derivatives using Leibnitz theorem.
5. Evaluation of definite integrals
6. Application of integration to calculate area bounded by curve.

Scheme of Examination

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part by conducting the Semester End Examinations with 60% marks in the second part. The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

(a) Internal assessment 40 %

Courses with tutorials (Mathematics)

Sr No	Evaluation type	Marks
1	One Assignments (one Tutorial converted into assignment) / Case studies / Project	10
2	One class Test [Tutorial converted into test]	20
3	Active participation in routine class instructional deliveries/Tutorials	05
4	Overall conduct as a responsible student, mannerism and articulation and exhibit of leadership qualities in organizing related academic actives	05

(b) External Theory examination 60 %

1. Duration – These examinations shall be of 2 Hours duration.
2. Theory Question Paper Pattern:-There shall be four questions each of 15 marks. On each unit there will be one question and the fourth one will be based on entire syllabus. All questions shall be compulsory with internal choice within the questions. (Each question will be of 20 to 23 marks with options.) Question may be subdivided into sub-questions a, b, c... and the allocation of marks depend on the weightage of the topic.

Guidelines about conduct of Tutorials/Assignments

1. Tutorials

Conduct and Evaluation: The tutorials should be conducted in batches formed as per the University circular. The tutorial session should consist of discussion between the teacher and the students in which students should participate actively. Each tutorial session should be evaluated out of 10 marks on basis of participation of student and the average of total aggregate should be taken.

2. Assignments

Conduct and Evaluation: The topic of the assignment and the questions should be given to the students at least one week in advance. The assignment should be such that it can be completed in 45 - 50 minutes by a student. The teachers may resolve the doubts of the students during the week, after which the students should submit the assignment. Each assignment should be evaluated out of 10 marks and the average of the total aggregate should be taken.
