JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program : B.Sc. /B.A

Proposed Course : Mathematics

Credit Based Semester and Grading System (CBCS) with effect from the academic year 2018-19

F.Y.B.Sc. / F.Y.B.A Syllabus

F.Y.B.Sc / F.Y.B.A. Mathematics Syllabus

Academic year 2018-2019

Semester I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SMAT 101/ AMAT 101	CALCULUS I	02	03
SMAT 102	ALGEBRA I	02	03
SMAT PR1/ AMAT PR1	PRACTICAL ON SMAT 101 / AMAT 101 AND SMAT 102/ AMAT 102	02	06

F.Y.B.Sc./B.A.

Introduction :

Mathematics pervades all aspects of life, whether at home, in civic life or in the workplace. It has been central to nearly all major scientific and technological advances. Many of the developments and decisions made in our community rely to an extent on the use of mathematics. Besides foundation skills and knowledge in mathematics for all citizen in the society, it is important to widen mathematical experience for those who are mathematically inclined.

Aims :

(a) Giving students sufficient knowledge of fundamental principles, methods and a clear perception of boundless power of mathematical ideas and tools and know how to use them by analysing, modeling, solving and interpreting.

(b) Reflecting on the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.

(c) Enhancing student's overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.

(d) A student should get adequate exposure to global and local concerns by looking at many aspects of mathematical Sciences.

Outcomes :

(a) Student's Knowledge and skills will get enhanced and they will get confidence and interest in mathematics, so that they can master mathematics effectively and will be able to formulate and solve problems from mathematical perspective.

(b) Student's thinking ability and attitude will change towards learning mathematics and practicals will improve their logical and analytical thinking.

SEMESTER I

SMAT 101 / AMAT 101 | CALCULUS I | 03 Lecture + 03 Practical

Course Description: We begin with a brief introduction of limits, continuity and differentiability which will enable students to form and solve differentiable equations. Variety of applications of differential equations will be demonstrated for real world problems. Next we will introduce real numbers and properties which will help students to understand the origin of number system. Basic theorems of real analysis like Archimedean property, Hausdorff property with applications will be introduced. After this we start with sequence of real numbers and concept of convergent sequences that will help students understand and solve problems which are widely prevalent in all branches of science.

Syllabus

Unit 1: Differential Equations (15L)

(1) Solutions of homogeneous and non-homogeneous differential equations of first order and first degree, Notion of partial derivative, solving exact differential equations.

(2) Rules for finding integrating factor (I.F) (without proof) for non-exact equations such as:

(i) $\frac{1}{Mx+Ny}$ is an I.F if $Mx + Ny = 0$ and $M\ dx + N\ dy$ is homogeneous.

(ii) $\frac{1}{Mx-Ny}$ is an I.F if $Mx - Ny = 0$ and $M\ dx + N\ dy$ is of the type $f_1(xy)ydx + f_2(xy)xdy$.

(iii) $e^{\int f(x)dx}$ is an I.F if $N = 0$ and $\frac{1}{N}(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x})$ is a function of x alone say $f(x)$.

(iv) $e^{\int f(y)dy}$ is an I.F if $M = 0$ and $\frac{1}{M}(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y})$ is a function of y alone say $f(y)$.

(3) Finding solutions of first order differential equations of the type $\frac{dy}{dx} + P(x)y = Q(x)y^n$ for $n \geq 0$. Applications to orthogonal trajectories, population growth, and finding the current at a given time.

Unit 2: Real Numbers (15L)

(1) Real number system R and order properties of R, Elementary consequences of these properties including AM-GM inequality.

(2) Absolute value function (modulus) on R, Examples and basic properties.

(3) Triangle inequality, Intervals and neighborhoods.

(4) Bounded sets of real numbers, Supremum(l.u.b) and Infimum (g.l.b), l.u.b and g.l.b property and its applications

(5) Archimedean property and its applications like Density theorem, nested interval theorem, existence of square root of 2

Unit 3: Sequences (15L)

(1) Definition of a sequence and examples, Convergence and divergence of sequences, Convergent sequence is bounded, Uniqueness of limit if it exists. Examples on convergence of a sequence using $-n_0$ definition.

(2) Sandwich theorem, Algebra of convergent sequences, Examples.

(3) Bounded sequences, Monotone sequences and their convergence.

(4) Standard examples such as a^n, $\frac{a^n}{n!}$, $(1+\frac{1}{n})^n$, $1+\frac{1}{1!}+\frac{1}{2!}+\cdots+\frac{1}{n!}$, $a^{\frac{1}{n}}(a>0)$, $n^{\frac{1}{n}}$.

(5) Cauchy sequences and their convergence, subsequences and their convergence, Bolzano-Weierstrass theorem.

Practicals for Calculus-I

(1) Solving exact and non-exact differential equations.

(2) Solving linear differential equations, Bernoulli's differential equations and its applications.

(3) Problems based on absolute value and properties of R.

(4) Problems on bounded sets and Archimedean property.

(5) Problems on convergent sequences.

(6) Problems based on subsequences and Cauchy sequences.

(7) Definitions and statements of important theorems.

References

[1] Dennis Zill, A first course in differential equations with modeling applications, Brooks/Cole ninth edition.

[2] R.G. Bartle and D.R. Sherbert, Introduction to real analysis, John Wiley and Sons.

[3] Ajit Kumar and S. Kumaresan, A basic course in real analysis, CRC press 2014.

Additional References

(1) G.F. Simmons, Differential equations with applications and historical notes, McGraw Hill.

(2) R.R. Goldberg, Method of real analysis, Oxford and IBH, 1984.

(3) T.M. Apostol, Calculus Volume I, Wiley and Sons (Asia).

(4) K.G. Binmore, Mathematical Analysis, Cambridge university press, 1984.

SMAT 102 ALGEBRA-I 03 Lecture + 03 Practical

Course Description: The aim of this course is to introduce students to basic concepts like sets, relations, equivalence relations and functions, etc. It will make students learn different techniques of proving theorems, lemmas using induction, proof by contradiction etc. We also equip them with integers, division algorithm, congruences and its applications.

Syllabus

Unit-1: Sets and functions (15L)

(1) Negation of a statement, use of quantifiers, sets, union and intersection of sets, complement of a set, De Morgan's law, Cartesian product of sets.

(2) Definition of a function; domain, co-domain and range of a function, composite functions, examples, Graph of a function, Injective, surjective, bijective functions; composite of injective, surjective, bijective functions when defined.

(3) Invertible functions, bijective functions are invertible and conversely. Examples of functions including constant, identity, projection, inclusion.

(4) Image and inverse image of a set under f interrelated with union, intersection and complement. Finite and infinite sets. Countable set and its examples such as Z, Q. Uncountable set and its examples.

Unit-2: Integers and divisibility (15L)

(1) Well-ordering property, First and second principle of mathematical induction as a consequence of well-ordering property

(2) Divisibility in integers, division algorithm, existence & uniqueness of greatest common divisor(g.c.d.) and least common multiple (l.c.m.) and their basic properties. Bezout's identity and its applications.

(3) Euclidean algorithm, Primes, Euclid's lemma, Fundamental theorem of arithmetic, The set of primes is infinite.

(4) The necessary and sufficient condition to have a solution for the linear Diophantine equation $ax + by = c$. Solving of linear Diophantine equation with examples.

Unit-3: Theory of congruences (15L)

(1) Equivalence relation, equivalence classes and properties, Definition of a partition, every partition gives an equivalence relation and vice versa. Congruences, definition and elementary properties, Congruence is an equivalence relation on Z, residue classes and partition of Z, addition modulo n, multiplication modulo n, examples

(2) Linear congruences. Chinese remainder theorem and its applications

(3) Euler's φ function, Euler's theorem, Fermat's little theorem, Wilson's theorem and their applications.

Practicals for Algebra-I

(1) Functions(image and inverse image), injective, surjective, bijective functions, finding inverses of bijective functions.

(2) Problems on countability.

(3) Problems on mathematical induction, Euclidean algorithm in Z.

(4) Problems on fundamental theorem of arithmetic and solving linear Diophantine equations.

(5) Problems on congruences, equivalence relation and Chinese remainder theorem.

(6) Problems on Euler's φ function, Fermat's little theorem, Wilson's theorem.

References

[1] S. Kumaresan, Ajit Kumar and Bhaba Kumar Sarma, A foundation course in Mathematics, 2018 edition, Narosa publication house.

[2] David M. Burton, Elementary number theory, seventh edition, Tata McGraw-Hill edition.

Additional references

(1) Ivan Niven, Herbert S. Zuckerman, Introduction to the theory of numbers, fifth edition, Wiley eastern limited.

(2) R.G. Bartle and D.R. Sherbert, Introduction to real analysis, third edition, John Wiley and Sons.

(3) Jones and Jones, Elementary number theory, second edition, Springer

(4) I.S. Luthar, Sets, functions and numbers, 2005 edition, Narosa publishing house.

(5) Thomas Koshy, Elementary number theory with applications, Academic press

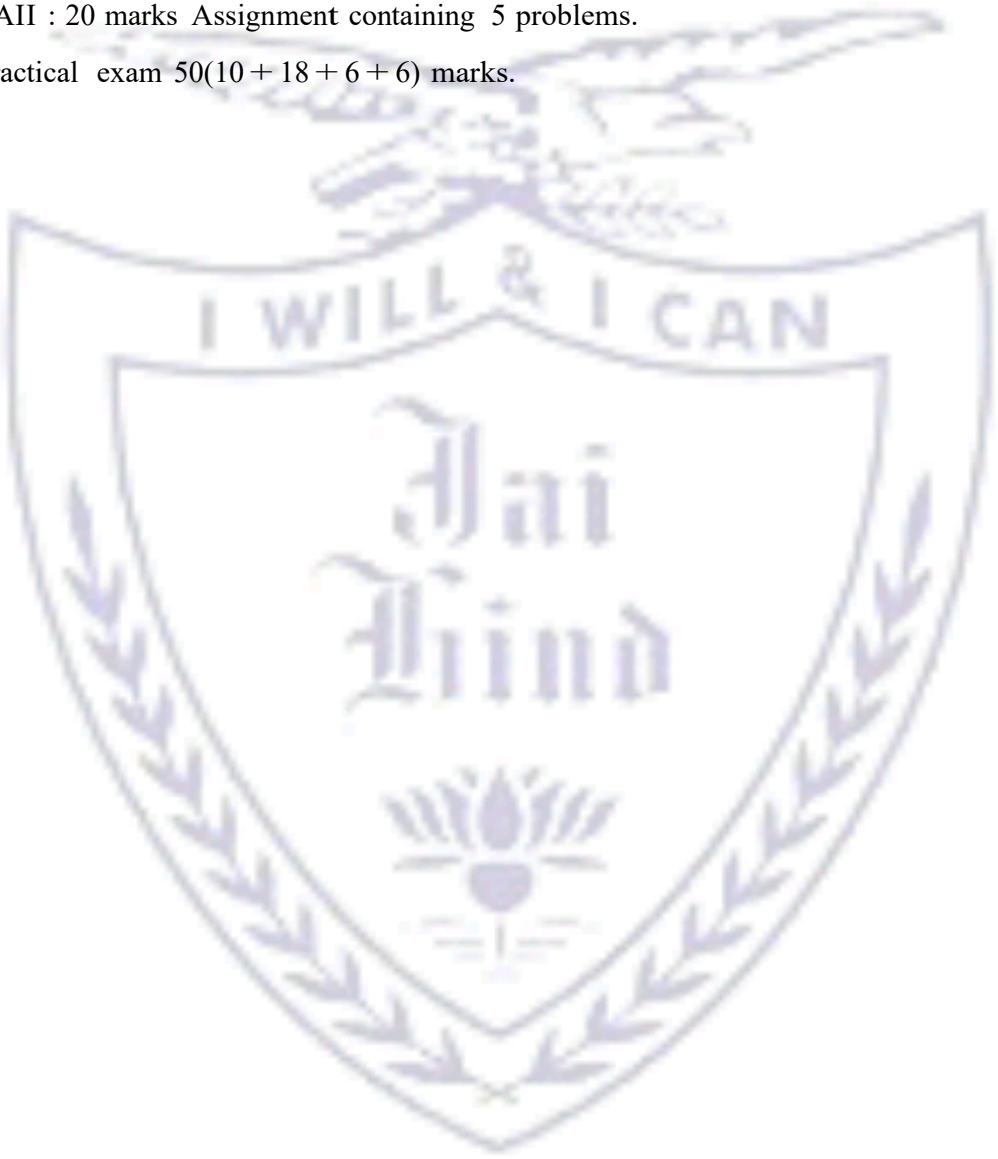
Exam pattern

(1) Semester End Exam (60 marks).

(2) CAI : 20 marks (Test).

(3) CAII : 20 marks Assignment containing 5 problems.

(4) Practical exam 50(10 + 18 + 6 + 6) marks.



Paper Pattern

(1) CA I : Problem solving test of 20 marks.

(2) CA II(Assignment): This is given to a group of students. The Pattern is:

(i) 5 Question based on Theorems

OR

(ii) 5 question based on Problems.

Semester End Exam Pattern

Based on Unit I

(Q.1/A) Attempt any 1 out of 2. 8 Marks each.

(Q.1/B) Attempt any 2 out of 3. 4 Marks each.

Based on Unit II

(Q.2/A) Attempt any 1 out of 2. 8 Marks each.

(Q.2/B) Attempt any 2 out of 3. 4 Marks each

Based on Unit III

(Q.3/A) Attempt any 1 out of 2. 8 Marks each.

(Q.3/B) Attempt any 2 out of 3. 4 Marks each

Based on Full Syllabus

(Q.4) Attempt any 2 out of 3. 6 Marks each.

Practical Exam Pattern

(Q.1) 10 Marks will be for question based on definitions, statements, multiple choice, True False, etc.

(Q.2) 6 Marks For Journal and 6 Marks for Viva.

(Q.3) 18 Marks Descriptive type where students have to solve 3 questions of 6 marks each out of 4 given choices.