JAI HIND COLLEGE AUTONOMOUS

Syllabus for FYBSc / BA

Course : Mathematics

Semester : II

Credit Based Semester & Grading System

With effect from Academic Year 2018-19

List of Courses

Course: Mathematics **Semester: II**

SR. NO.	COURSE CODE	COURSE TITLE	NO. OF LECTURES / WEEK	NO. OF CREDITS
FYBSC / BA				
1	SMAT 201/ AMAT 201	Calculus II	3	2
2	SMAT 202	Algebra II	3	2
3	SMAT2 PR2 /AMAT2 PR2	Practical-II (Based on SMAT 201/AMAT 201, SMAT 202)	3	2

Course Code SMAT 201 AMAT 201	Course Title : Calculus II (No. of credits 2 No. of Lecture / week 3)	
Course Description: The aim of this course is to expose students to the beauty of limits, continuity and the concept of differentiation. The first unit is based on limits and conti- nuity in which students learn the definition of continuity and sequential continuity and the equivalence between them. Problems based on these concepts are solved rigourously. The next unit is based on differentiability. Here students understand the notion of differentiation of a real valued function and mean value theorems. In the last section the emphasis is on applications of differentiability.		
Unit I	**Limits and continuity**	**15 L**
	(1) -δ definition of limit of a (real valued) function, Right hand and Left hand limits, Uniqueness of limit when it exists, Algebra of limit of a function, Sandwich theorem. (2) -δ definition of continuity of a (real valued) function, examples, Sequential continuity. (3) Alebra of continuous functions, Continuity of $\|f\|$ when f is continuous. Continuity of composition of two continuous functions. (4) Examples of discontinuous functions and continuity of constant function, identity func- tion, trigonometric functions, polynomial functions etc. (5) Intermediate value theorem and its applications, A continuous function on a closed and bounded interval is bounded and attains its bounds and its consequences.	
Unit II	**Differentiability**	**15 L**
	(1) Differentiation of a real-valued function, examples of differentiable and non-differentiable functions, differentiability implies continuity, Algebra of differentiable functions,Derivative of a inverse function. (2) Chain-Rule, Higher order derivatives, Leibnitz rule, L'Hospital's rule, examples of in- determinate form. (3) Rolle's theorem, Lagrange's and Cauchy's mean value theorem, their applications and examples.	
Unit III	**Applications of Differentiation**	**15 L**
	(1) Taylor's theorem and its applications. (2) Definition of local maximum and local minimum, necessary condition, stationary points, first and second derivative test, examples, Graphing of functions using first and second derivatives. (3) Application to economics and commerce, Concave, convex functions, points of inflec- tions.	

Practicals for Calculus-II

(1) Problems on limits and continuity using definiton

(2) Problems on sandwich theorem and intermediate value theorem.

(3) Problems on differentiability and Leibnitz rule, L'Hospital's rule

(4) Problems based on mean value theorems.

(5) Problems on local maxima and minima.

(6) Concavity of curves with graphs.

References

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

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

[3] James Stewart, Calculus: early transcendentals, Cengage, 7th edition 2017.

Additional References

(1) Strauss, Bradley and Smith, Calculus, Pearson 3rd edition, 2002. (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.

Course Code SMAT 202	Course Title : Algebra II (No. of credits 2 No. of Lecture / week 3	
Course Description: The aim of this course is to introduce System of linear equations and matrices and to understand polynomials over R and permutations of a set. The first unit is devoted to system of linear equations. We then proceed to introduce permutations, symmetries, cycles and give its applicaions. In the last unit we introduce polynomials over set of reals and complex numbers. We also introduce gcd of two polynomials over R, Euclidean algorithm and solve problems based on that. Different techniques using rational root theorem will enable students to find roots of a polynomialemphasis is on applications of differentiability.		
Unit I	**System of linear equations and matrices**	**15 L**
	(1) System of homogeneous and non-homogeneous linear equations, the solution of system of m homogeneous linear equations in n unknowns by elimination and its geometrical interpretation. (2) Definition of an n-tuple of real numbers, sum of two n-tuples and scalar multiplication of an n-tuple. (3) Matrices with real entries; addition, scalar multiplication and multiplication of matri- ces; transpose of a matrix, types of matrices: zero matrix, identity matrix, diagonal matrices, triangular matrices, symmetric matrices, skew-symmetric matrices, invertible matrices, identities such as $(AB)^t = B^tA^t$, $(AB)^{-1} = B^{-1}A^{-1}$ (4) System of linear equations in matrix form, elementary row operations, row echelon form, Gauss elimination method, the system of m homogeneous linear equations in n unknowns has a non-trivial solution if $m < n$.	
Unit II	**Permutations**	**15 L**
	1) Definition of a permutation of a set, Set of all permutations of the set {1, 2, ..., n} i.e. S_n and its cardinality, Symmetries of an equilateral triangle, square, rectangle. (2) Cycles, Composition of permutations, properties of permutations such as every permu- tation of a finite set can be written as a cycle or a product of disjoint cycles, disjoint cycles commute. (3) Transpositions, Any permutation can be expressed as a product of transpositions, order of a permutation, sign of a permutation.	
Unit III	**Polynomials**	**15 L**
	(1) Definition of a polynomial, polynomials over the field F where F = Q, R or C, Algebra of polynomials, degree of a polynomial, basic properties. (2) Division algorithm for polynomials over R, gcd of two polynomials and its basic proper- ties, Euclidean algorithm and its applications, roots of a polynomial, relation between roots and coefficients, multiplicity of a root, remainder theorem, factor theorem.	

	(3) A polynomial of degree n has atmost n roots, Complex roots of a polynomial in R[X] occur in conjugate pairs, statement of Fundamental theorem of algebra, a polynomial of degree n. (4) Rational root theorem and its consequences such as $\sqrt{p}$ is an irrational number when p is a prime number, roots of unity, sum of all the root of unity	

Course Code SMAT 2 PR2 AMAT2 PR2	**Course Title : Practical II** **(No. of credits 2 No. of Lecture / week 3**
	Practicals for Algebra-II (1) Problems of solving homogeneous system of m equations and n unknowns by elimina- tion, problems on row echelon form (2) Solving a system Ax = b by Gauss elimination, finding inverse of a matrix if it exists, solutions of system of linear equations. (3) permutations of a finite set, Symmetries, cycles, compositions of permutations. (4) Permutation as a product of 2-cycles, order and sign of a permutation. (5) Problems on division algorithm and gcd of two polynomials. (6) Problems based on factor theorem, remainder theorem and rational root theorem

References

[1] S. Kumaresan, Linear algebra, a geometric approach first edition, Prentice hall of India, 2009.

[2] Joseph A. Gallian, Contemporary abstract algebra, fourth edition, Narosa publica- tions.

[3] John Fraleigh, A first course in abstract algebra, seventh edition, Pearson, 2013

Additional References

(1) Norman L. Biggs, Discrete mathematics, second edition, Oxford university press. (2) I.N. Herstein, Topics in algebra, second edition, Wiley India edition.

(3) Serge Lang, Introduction to linear algebra, second edition, Springer.

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.