UNIVERSITY OF PUNE, PUNE.

Syllabus for F.Y.B.Sc(Computer Science)

Subject: MATHEMATICS

(With effect from June 2013)

Introduction:

University of Pune has decided to change the syllabi of various faculties from June,2013. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects Board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to University of Pune has prepared the syllabus of F.Y.B.Sc. (Computer Science) Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

i)Give the students a sufficient knowledge of fundamental principles ,methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.
ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.
iii)Enhancing students' 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 .
iv) Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

(i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays ,state important facts resulting from their studies.

(ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.

(iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

(iv) A student be able to apply their skills and knowledge ,that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Eligibility: 12th science with mathematics or equivalent examination.

Structure of the course:

Sr.No.	Paper	Theory	Oral	Internal	Total
1	MTC 101 (Discrete Mathematics)	80 Marks	-	20 Marks	100 Marks
2	MTC 102 (Algebra and Calculus)	80 Marks	-	20 Marks	100 Marks
3	MTC 103 (Mathematics Practicals)	72 Marks	08 Marks	20 Marks	100 Marks

All 3 above courses are compulsory.

Medium of Instruction: English

Examination:

A) Pattern of examination: Annual.

B) Standard of passing : 40 Marks out of 100 marks for each papers.

But for MT 101 and MT 102 for passing a student should obtain minimum 32 marks out of 80 in the theory examination and overall total marks for theory and internal should be minimum 40.

C)Pattern of question papers: For MTC 101 and MTC 102

Q1. Attempt any 08 out of 10 questions each of 02 marks. [16 Marks]
(05 questions from each term)

Q2. Attempt any 04 out of 06 questions each of 04 marks. [16 Marks**].**
(Based on term I)

Q.3. Attempt any 02 out of 03 questions each of 08 marks. [16 Marks].
(Based on term I)

Q4. Attempt any 04 out of 06 questions each of 04 marks. [16 Marks].
(Based on term II)

Q.5. Attempt any 02 out of 03 questions each of 08 marks. [16 Marks].
(Based on term II)

The pattern of question paper for MTC 103 is given in the detailed syllabus.

D) External Students: Not allowed.

E)Verifation/Revaluation: Allowed for MTC 101,MTC 102.

Equivalence of Previous syllabus along with new syllabus:

Sr.No	New Courses	Old Courses
1	MTC 101 (Discrete Mathematics)	Paper I (Discrete Mathematics)
2	MTC 102 (Algebra and Calculus)	Paper II (Algebra and Calculus)
3	MTC 103 (Mathematics Practicals)	Paper III (Mathematics Practicals)

Qualifications for Teacher

M.Sc. Mathematics (with NET /SET as per existing rules

Details of Syllabus

MTC 101: Discrete Mathematics

First Term

Unit 1: Logic **07 Lectures**

1.1 Revision : Propositional Logic, Propositional Equivalences.
1.2 Predicates and Quantifiers : Predicate, *n*-Place Predicate or ,*n*-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.
1.3 Rules of Inference : Argument in propositional Logic, Validity Argument(Direct and Indirect methods) Rules of Inference for Propositional Logic, Building Arguments.

Unit 2 : Lattices and Boolean Algebra **10 Lectures**

2.1 Poset, Hasse diagram.
2.2 Lattices, Complemented lattice, Bounded lattice and Distributive lattice.
2.3 Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
2.4 Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Unit 3 : Counting Principles **10 Lectures**

3.1 Cardinality of Set : Cardinality of a finite set.
3.2 Basics of Counting : The Product Rule, The Sum Rule, The Inclusion-Exclusion Principle.
3.3 The Pigeonhole Principle: Statement, The Generalized Pigeonhole Principle, Its Applications.
3.4 Generalized Permutations and Combinations : Permutation and Combination with Repetitions, Permutations with Indistinguishable Objects, Distributing objects into boxes : Distinguishable objects and distinguishable boxes, Indistinguishable objects and distinguishable boxes, Distinguishable objects and Indistinguishable boxes, Indistinguishable objects and Indistinguishable boxes

Unit 4 : Recurrence Relations **9 Lectures**

4.1 Recurrence Relations : Introduction, Formation.
4.2 Linear Recurrence Relations with constant coefficients.
4.3 Homogeneous Solutions.
4.4 Particular Solutions.
4.5 Total Solutions.

Second Term

Unit 5 : Graphs **06 Lectures**

5.1 Definition, Elementary terminologies and results, Graphs as Models.
5.2 Special types of graphs.
5.3 Isomorphism.
5.4 Adjacency and Incidence Matrix of a Graph.

Unit 6 : Operations on Graphs **04 Lectures**

6.1 Subgraphs, induced subgraphs,Vertex delition, Edge delition.
6.2 Complement of a graph and self-complementary graphs.
6.3 Union, Intersection and Product of graphs.
6.4 Fusion of vertices.

Unit 7 : Connected Graphs. **09 Lectures**

7.1 Walk, Trail, Path, Cycle : Definitions and elementary properties.
7.2 Connected Graphs : definition and properties.
7.3 Distance between two vertices, eccentricity, center, radius and diameter of a graph.
7.4 Isthmus, Cutvetex : Definition and properties.
7.5 Cutset, edge-connectivity, vertex connectivity.
7.6 Weighted Graph and Dijkstra's Algorithm.

Unit 8 : Eulerian and Hamiltonian Graphs **05 Lectures**

8.1 Seven Bridge Problem, Eulerian Graph : Definition and Examples, Necessary and Sufficient condition.
8.2 Fleury's Algorithm.
8.3 Hamiltonian Graphs : Definition and Examples, Necessary Condition.
8.4 Introduction of Chinese Postman Problem and Travelling Salesman Problem.

Unit 9 : Trees **06 Lectures**

9.1 Definition, Properties of trees.
9.2 Center of a tree.
9.3 Binary Tree : Definition and properties.
9.4 Tree Traversal : Ordered rooted Tree, Preorder traversal, inorder traversal and postorder traversal, Prefix Notation.
9.5 Spanning Tree : Definition, Properties, Shortest Spanning Tree, Kruskal's Algorithm.

Unit 10 : Directed Graphs **06 Lectures**

10.1 Definition, Examples Elementary Terminologies and properties.
10.2 Special Types of Digraphs.
10.3 Connectedness of digraphs.
10.4 Network and Flows : definition and examples.

Text Book: Text book of Discrete Mathematics, Prepared by B.O.S. in Mathematics, University of Pune, Pune.(2013).

Reference Books:

1) Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill)

2) C. L. Liu ,Elements of Discrete Mathematics, (Tata McGraw Hill)

3) John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers)

4) Narsingh Deo, Graph Theory with Applications to Computer Science and Engineering, (Prentice Hall).

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MTC 102: Algebra and Calculus

First Term: (Algebra)

Unit 1: Relations and functions **11 Lectures**

1.1 Ordered pairs, Cartesian product of Sets.

1.2 Relations, types of relations, equivalence relations. Partial orderings.

1.3 Equivalence Class, properties and partition of a set.

1.4 Transitive closure and Warshall's Algorithm.

1.5 Digraphs of relations, matrix representation and composition of relations.

1.6 Definition of function as relation, types of functions (one-one, onto and bijective)

Unit 2: Binary Operations and Groups. **9 Lectures**

2.1 Definition of binary operation, examples, properties of binary operations.
2.2 Definition of Monoid, semigroup, examples.

2.3 Definition of group and examples, finite and infinite groups, permutation groups, subgroups, Cyclic groups.

Unit 3: Divisibility in Integers **16 Lectures**

3.1 Well ordering principle

3.2 First and second Principle of Mathematical Induction, Examples

3.3 Division Algorithm (without proof)

3.4 Divisibility and its properties, prime numbers.

3.5 Definition G.C.D and L.C.M., Expressing G.C.D. of two integers as a linear combination of the two integers.

3.6 Euclidean Algorithm (Without proof).

3.7 Relatively prime integers, Euclid are Lemma and its generalization.

3.8 Congruence relations and its properties, Residue Classes: Definition, Examples, addition and multiplication modulo n and composition tables

3.9 Euler's and Fermat's Theorems. (Without proof).Examples

Second Term: (Calculus)

Unit 4: Continuity and Differentiability **12 Lectures**

4.1 Continuity and Properties of continuous functions defined on [a, b] (Without proof) and examples.

4.2 Differentiability

4.3 Theorem – Differentiability implies continuity but not conversely. Left hand derivative and Right hand derivative.

4.4 Intermediate value theorem (without proof).

4.5 Rolle's theorem (with proof and geometric interpretation)

4.6 Lagrange's Mean Value Theorem (with proof and geometric interpretation)

4.7 Cauchy's Mean Value Theorem (with proof), Verification and Application.

4.8 L' Hospital's Rule (without proof)

Unit 5: Successive Differentiation **05 Lectures**

5.1 The n^{th} derivatives of standard functions.

5.2 Leibnitz's Theorem (with proof).

Unit 6: Taylor's and Maclaurin's Theorems **05 Lectures**

6.1 Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders (without proof).
6.2 Taylor's and Maclaurin's Series.

Unit 7 : Matrices and System of Linear Equations **14 Lectures**

7.1 Revision: Elementary operations on matrices.
7.2 Echelon form of matrix
7.3 System of linear equations: Gauss Elimination Method, Gauss –Jordan Elimination Method, L.U. Decomposition Method
7.4 Rank of matrix, Row rank, Column rank

Text Book: Text book of Algebra and Calculus, Prepared by B.O.S. in Mathematics, University of Pune, Pune.(2013).

Reference Books:

1) Discrete Mathematics Structure – Bernard Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, Pearson Education, 5th Edition
2) Elements of Discrete Mathematics – C.L.Liu (Tata McGraw Hill)
3) Calculus and Analytical Geometry- Thomas Finny
4) J.B. Fraleigh, A. First Course in Abstract Algebra, Third Ed., Narosa, New Delhi, 1990
5) H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Ed., Wiley, (1994).

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MTC 103: Mathematics Practicals

(Practicals based on the applications of articles in MTC 101 and MTC 102)

List of Practicals:

TERM I

1. Logic
2. Lattices
3. Boolean Algebra .
4. Counting Principles.
5. Recurrence Relations
6. Miscellaneous.
7. Relations and functions.
8. Binary Operations
9. Groups
10. Divisibility in Integers I
11. Divisibility in Integers II.
12. Miscellaneous.

TERM II

13. Graphs and Operations on Graphs.
14. Connected Graphs.
15. Eulerian and Hamiltonian Graphs.
16. Trees
17. Directed Graphs.
18. Miscellaneous.
19. Continuity and Differentiability.
20. Mean value theorems and L'Hospital rule.
21. Successive Differentiation.
22. Taylor's and Maclaurin's Theorems.
23. Matrices and System of Linear Equations.
24. Miscellaneous.

Modalities For Conducting The Practical and The Practical Examination

1) There will be one 3 hour practical session for each batch of 15 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 MT 101 and 25 on MT 102) will be the course work for this paper. Question Bank will be prepared by the individual subject teacher and the problems included should be changed every year, based on the list of practicals given above. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.

3) The College will conduct the Practical Examination at least 15 days before the commencement of the Main Theory Examination. The practical examination will consist of written examination of 72 marks and oral examination of 08 marks.

4) There will be no external examiner; the practical exam will be of the duration of 3 hours.

5) The subject teacher will set a question paper based on pattern as follows:

Q1. (a) Any 1 out of 2 worth 8 marks on MTC101 (first term).
(b) Any 1 out of 2 worth 8 marks on MTC 102(First term).
Q2*. Any 5 out of 7 each of 4 marks on MTC 101.
Q3*. Any 5 out of 7 each of 4 marks on MTC 102.
Q4. (a) Any 1 out of 2 of 10 marks on MTC 101(second term).
(b) Any 1 out of 2 worth 10 marks on MTC 102(second term).

(*In Q2 and Q3, there will be 3 questions from first term and 4 questions from the second term or vice-versa.)

6) Each student will maintain a journal to be provided by the college.

7) The internal 20 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.

8) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.

8) The subject teachers must include computer practicals based on use of free mathematical software's like Sclib, Maxima, mu-pad, etc. for solving problems in the miscellaneous practical mentioned above.

10) **Special Instruction:** Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed**.**

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