University of Pune

Board of Studies in Mathematics

S. Y. B. Sc. (Comp. Sc.)

Syllabus of Mathematics

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 S.Y.B.Sc. Comp.Sci. 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 aninteresting 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: F.Y.B.Sc. Comp.Sci.,as per University rules

Structure of the course:

	Semester - I		**Semester -II**	
Paper I	Applied Algebra	(MTC :211)	Computational Geometry	(MTC:221)
Paper II	Numerical Analysis	(MTC:212)	Operations Research	(MTC:222)
Paper III	Practical			(MTC:223)

In paper I and II, each course is of 50 marks (40 marks theory and 10 marks internal examination)

Paper III is is of 100 marks

Medium of Instruction: English

Examination:

A) Pattern of examination: Paper I and II:Semester wise
PaperIII: Practical Annual

B) Standard of passing :For Paper I and II: 20 Marks out of 50 marks for eachcourse.

But for passing a student should obtain minimum 16 marks out of 40 in the theory and oral examination and overall total marks for theory, oral and internal should be minimum 20.

C)**Pattern of question papers: For Paper I and Paper II**

Q1. Attempt any 05 out of 07 questions each of 02 marks. [10Marks]

Q2. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.3. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.4. Attempt any 01 out of 02 questions each of 10 marks. [10 Marks].

The pattern of question paper for Paper III : Given in details of Syllabus

D) External Students: Not allowed.

E) Variation / Revaluation: Allowed for Paper I and II.

F) Qualifications for Teacher: M.Sc. Mathematics (with NET /SET as per existing rules)

Equivalence of Previous syllabus along with new syllabus:

Semester I		Semester II	
New Course	**Old Course**	**New Course**	**Old Course**
(MTC :211) Applied Algebra	(MTC :211) Linear Algebra	(MTC:221) Computational Geometry	(MTC:221) Computational Geometry
(MTC:212) Numerical Analysis	(MTC:212) Numerical Analysis	(MTC:222) Operations Research	(MTC:222) Operations Research
MTC 223 Practical			

Applied Algebra (MTC: 211)

1. General Vector Spaces: [14]
   1.1 Real vector spaces.
   1.2 Subspaces.
   1.3 Linear independence.
   1.4 Basis and dimensions.
   1.5 Row space, Column space and null space.
   1.6 Rank and Nullity.
2. Eigen values and Eigen vectors:
   2.1 Eigen values and Eigen vectors. [09]
   2.2 Diagonalization.
   2.3 Quadratic forms.
3. Linear Transformations: [10]
   3.1 General linear transformations.
   3.2 Kernel and range. (Rank nullity theorem without proof.)
   3.3 Inverse linear transformation.
   3.4 Matrix of general linear transformation.
4. Groups and Coding: [15]
   4.1 Cyclic group, normal subgroup.
   4.2 Products and quotients of groups.
   4.3 Coding of binary information and error detection.
   4.4 Decoding and error correction.
   4.5 Public key cryptology.

Note: All theorems in sections 1.5, 1.6, 2.2, 2.3, 2.4, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4 are without proofs.

Text Book:

1. Elementary Linear Algebra (Applications Version) by Howard Anton, Chris Rorres. (Seventh Edition) John Wiley & Sons, Inc.
   Sections: 5.1 to 5.6, 7.1, 7.2, 9.5, 9.6, 8.1 to 8.4

2. Discrete Mathematical Structures (sixth edition), Kolman, Busby and Ross. PHI.
   Sections: 9.5, 11.1 to 11.3

Reference Books:

(1) M. Artin, Algebra, Prentice Hall of India , New Delhi, (1994).
(2) K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India New Delhi, (1998).
(3) S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New Yark, (1986).
(4) A. Ramchandra Rao and P. Bhimasankaran, Linear Algebra, Tata McGraw Hill, New Delhi (1994).
(5) G. Strang, Linear Algebra and its Applications. Third Ed. Harcourt Brace Jovanovich, Orlando, (1988).

Numerical Techniques (MTC: 212)

1. Errors [02]
   1.1 Accuracy of Numbers
   1.2 Errors
2. Algebraic and Transcendental Equation [05]
   2.1 False Position Method
   2.2 Newton-Raphson Method
3. Calculus of Finite Differences [10]
   3.1 Differences
      3.1.1 Forward Differences
      3.1.2 Backward Differences
      3.1.3 Central Differences
      3.1.4 Other Differences
      3.1.5 Properties of Operators
      3.1.6 Relation between Operators
   3.2 Fundamental Theorem on Differences of polynomial
   3.3 Estimation of Error by Difference Table
   3.4 Technique to determine the Missing Term

4. Interpolation with Equal Interval [10]
   4.1 Newton's Gregory Formula for Forward Interpolation
   4.2 Newton's Gregory Formula for Backward Interpolation
   4.3 Central Difference Formulae
      4.3.1 Gauss Forward Difference Formula
      4.3.2 Gauss Backward Difference Formula
      4.3.3 Bessel's Interpolation Formula
5. Interpolation with Unequal Interval [08]
   5.1 Lagrange's Interpolation Formula
   5.2 Error in Lagrange's Interpolation Formula
   5.3 Divided Difference
   5.4 Newton's Divided Difference Formula
   5.5 Hermite's Interpolation Formula

6. Numerical Integration [06]
   6.1 General Quadrature Formula
   6.2 Trapezoidal Rule
   6.3 Simpson's one-Third Rule
   6.4 Simpson's Three-Eight Rule
   6.5 Euler-Maclaurin's Formula
7. Numerical Solution of Ordinary Differential Equation [07]
   7.1 Euler's Method
   7.2 Euler's Modified Method
   7.3 Runge-Kutta Method
   7.4 Milne's Predictor-Corrector Method

Text Book:-

A textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal. New Age International Publichers.

Sections: 1.2, 1.3, 1.3, 2.1, 2.5, 2.7, 3.1, 3.2, 3.4, 3.5, 3.6, 3.7, 4.1, 4.2, 4.3, 4.4.1, 4.4.2, 4.4.4, 4.5, 5.1, 5.2, 5.3.1, 5.4, 5.5, 5.6, 6.1, 6.3, 6.4, 6.5, 6.6, 6.7, 6.10, 7.1, 7.4, 7.5, 7.6, 7.7

Reference Books:-

1. S.S. Sastry; Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999.
2. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.
3. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.
4. Balguruswamy; Numerical Analysis.

Computational Geometry (MTC : 221)

1. Two dimensional transformations: [16]

1.1 Introduction.
1.2 Representation of points.
1.3 Transformations and matrices.
1.4 Transformation of points.
1.5 Transformation of straight lines.
1.6 Midpoint transformation.
1.7 Transformation of parallel lines.
1.8 Transformation of intersecting lines.
1.9 Transformation: rotations, reflections, scaling, shearing.
1.10 Combined transformations.
1.11 Transformation of a unit square.
1.12 Solid body transformations.
1.13 Transformation and homogeneous coordinates. Translation.
1.14 Rotation about an arbitrary point.
1.15 Reflection through an arbitrary line.
1.16 Projection – a geometric interpretation of homogeneous coordinates.
1.17Overall Scaling.
1.18 Point at infinity.

2. Three dimensional transformations: [16]

2.1 Introduction.
2.2Three dimensional – Scaling, shearing, rotation, reflection, translation.
2.3 Multiple transformations.
2.4 Rotation about – an axis parallel to coordinate axes, an arbitrary axis in space.
2.5Reflection through – coordinate planes, planes parallel to coordinate planes, arbitrary planes.

2.6 Affine and perspective transformations.
2.7 Orthographic projections.
2.8Axonometric projections.
2.9 Oblique projections.
2.10 Single point perspective transformations.
2.11Vanishing points.

3. Plane Curves: [10]

3.1 Introduction.
3.2 Curve representation.
3.3 Non – parametric curves.
3.4 Parametric curves.
3.5 Parametric representation of a circle and generation of circle.
3.6 Parametric representation of an ellipse and generation of ellipse.
3.7 Parametric representation of a parabola and generation of parabolic Segment.
3.8 Parametric representation of a hyperbola and generation of hyperbolic segment.

4. Space curves: [6]

4.1 Bezier Curves – Introduction, definition, properties (without proof), Curve fitting (up to n = 3), equation of the curve in matrix form (upto n = 3)

Textbook:

D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intnl Edition.

Reference books:

- Schaum Series, Computer Graphics.
- M. E. Mortenson, Computer Graphics Handbook, Industrial Pres Inc

Operations Research (MTC:222)

1. **Modeling with Linear Programming** [06]
   1.1 Two-Variable LP Model
   1.2 Graphical LP Solution
   1.3 Linear Programming Applications
      1.3.1 Production Planning and Inventory Control
2. **The Simplex Method** [12]
   2.1 LP Model in Equation Form
   2.2 Transition from Graphical to Algebraic Solution
   2.3 The Simplex Method
   2.4 Artificial Starting Solution
      2.4.1 M-Method
   2.5 Special Cases in Simplex Method
3. **Duality** [08]
   3.1 Definition of the dual problem
   3.2 Primal dual relationships
4. **Transportation Model and Its Variants** [12]
   4.1 Definition of the Transportation problem
   4.2 The Transportation Algorithm
   4.3 The Assignment Model

5. **Decision Analysis and Games** [10]
   5.1 Optimal solution of two person zero sum games
   5.2 Solution of mixed strategy games

Text Book:-

Operation Research (An Introduction) Ninth Edition, by Hamdy A. Taha.

Sections: 2.1, 2.2, 2.4.2, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 5.1, 5.3, 5.4, 15.4

Reference Books:-

1. Operations Research by S. D. Sharma
2. Operations Research by R. Panneerselvam, Prentice Hall of India.
3. Principles of Operations Research by H. M. Wagner, Prentice Hall of India.
4. Operations Research by Gupta and Hira.
5. Operation Research by J.K. Sharma

Paper III : Mathematics practical (MTC:223)

(Semester – I)

1. **Using scilab**

i. Revision of scilab with some basic commands

e.g. size,length,eye,ones,rand,zeros etc.

ii. Use of ‘ deff ‘ command for one and two variables functions.

iii. Draw 2-D and 3-D graph for some standard functions.

e.g. x^2 , sin (x), exp(x), x^3+y^3 etc .

2. **Using scilab**

i. basic operations on matrices .

e.g. addition , subtraction, multiplication ,square etc.

ii. solution for system of linear equation .

3. **Scilab programming** :

i. Regula-Falsi Metho.

ii. Newton-Raphson Method.

4 . **Using scilab** .

i. Eigen values and Eigen vectors.

ii. Diagonalization.

5. **Scilab programming** :

i. Newton’s forward interpolation formula.

ii. Newton’s backward interpolation formula.

6. **Scilab programming** :

i. Lagranges interpolation for unequal interval.

ii. Newton’s divided difference formula.

7. **Scilab programming** :

i. Numerical Integration by Trapezoidal method.

ii. Numerical Integration by Simpson’s (1/3)rd ule.

iii. Numerical Integration by Simpson’s (3/8)th rule.

8. **Scilab programming** :

i. Euler’s Method

ii. Runge-Kutta Method

9. **Written practical** : Coding Theory and cryptology.

Semester II

10. **C -programming**

i. Sorting a set of points with respect to a line.

ii. Sorting a set of points with respect to a rectangle.

11. **C- programming**

i. Find a pair of points with least mutual mutual distance from the given set

ii. Find a pair of points with fartest mutual distance from the given set

12. **Written practical :** Solution of L. P. P. by simplex method

Verification by TORA

13**. Written practical** : 2 -D ransformations

14. Written practical : Transportation and assignment problem

Verification by TORA

15. Written practical : 3 -D ransformations.

16. **C - programming**

i. Generation of uniformly n- points on standard Circle

ii. Generation of uniformly n- points on standard Ellipse

17. **C -programming**

i. Sorting a set of points with respect to a polygon

ii. Sorting a set of points with respect to a rectangular block

18. **Written practical** : Be'ziers curve

Instructions:

1. The annual examination is of 80 marks and 20 marks are based on internal evaluation (journal, attendance ,vivo-voce etc).
2. The annual examination of 80 marks having 3 hours duration and has two parts
   i. Question paper solving ii. Computer Session
3. The maximum marks for the question paper is 30 and is of 1 hr duration. there will be 5 questions ; each of 10 marks and student has two solve any three questions .
4. Computer session is of 2 hrs duration . It consist of two questions with first on C' programming of 20 marks .and second on scilab of 30 marks with internal options .
5. The slips for the questions on c-programming and problems solving by scilab should be prepared and can be use in annual examination at least for 3 years.

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