UNIVERSITY OF PUNE, PUNE.

Syllabus for F.Y.B.A.

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 and new approaches in different areas of mathematics and related subjects Board of Studies in Mathematics in consultation with teachers of Mathematics from different colleges affiliated to University of Pune has prepared the syllabus of F.Y.B.A. Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

i) Give the students sufficient knowledge of fundamental principles, methods and a clear perception of the 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.

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:

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.

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

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

A student should be able to apply her 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.

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

Eligibility: 12th pass with mathematics or equivalent examination.

Structure of the course:

Sr.No.	Paper	Theory	Term End	Total
1	FMG 1: Industrial Mathematics	80 Marks	20 Marks	100 Marks
2	MG 1 : Mathematics General Paper – I	80 Marks	20 Marks	100 Marks
3	AMG 1: Applied Mathematics General – I	80 Marks	20 Marks	100 Marks

All the above 3 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 paper.

But for passing, a student should obtain minimum 32 marks out of 80 in the final theory examination and total marks for theory and term-end examinations should be minimum 40.

C) Pattern of question papers:

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)

D) External Students: allowed.
E) Verification/ Revaluation: Allowed.

Equivalence of Previous syllabus along with new syllabus:

Sr.No	New Courses	Old Courses
1	FMG 1: Industrial Mathematics	FMG 1: Industrial Mathematics
2	MG 1 : Mathematics General Paper – I	MG 1 : Mathematics General Paper – I
3	AMG 1: Applied Mathematics General – I	AMG 1: Applied Mathematics General – I

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

Details of Syllabus:

FMG 1: Industrial Mathematics :

FIRST TERM

Unit 01: **Review of Basic Concepts:** **7 Lectures**

Basic Algebra: Simultaneous Equations. Functions, Graphs, Slopes and Intercepts, Graphs of Non-linear functions.

Unit 02: **The Derivative and the rules of differentiation:** **12 Lectures**

Limits, Continuity, The slope of a curvilinear function, The derivative, Differentiability and continuity, Derivative notation, Rules of Differentiation, Higher order derivatives, Implicit differentiation.

Unit 03: **Use of derivative in Mathematics and Economics**: **18 Lectures**

Increasing and Decreasing Functions, Concavity and Convexity, Relative Extrema,Inflection Points, Curve Sketching, Optimization of Functions, Marginal Concepts, Optimizing Economic Functions, Price Elasticity of Demand and Supply, Relationship among Total, Marginal, and Average Concepts.

SECOND TERM

Unit 04: F**undamentals of linear (or matrix) algebra** **15 Lectures**

The Role of Linear Algebra, Definitions and Terms, Addition and Subtraction of Matrices, Scalar Multiplication, Vector Multiplication, Multiplication of Matrices,

Commutative, Associative, and Distributive Laws in Matrix Algebra, Identity and Null Matrices, Matrix Expression of a System of Linear Equations, Row

Operations, Augmented Matrix**,** Gaussian Method of Solving Linear Equations

Unit 05: **Integral calculus: the indefinite integral** **15 Lectures**

Integration, Rules of Integration, Initial Conditions and Boundary Conditions, Integration by Substitution, Integration by Parts, Economic Applications

Unit 06: L**inear programming: a graphic approach** **15 Lectures**

Graphic Solutions, The Extreme Point Theorem,Slack and Surplus Variables ,The Basic Theorem.

Text Book:

1) Mathematical Economics, 2/ed , Edward T. Dowling ,

Schaum's outline series, McGraw Hill International Edition

[Chapter 1 (1.1 to 1.9), Chapter 3 (3.1 to 3.9), Chapter 4 (4.1 to 4.10),

Chapter 10 (10.1 to 10.12), Chapter 13 (13.1 to 13.4), Chapter 16 (16.1 to 16.6).]

MG 1 : Mathematics General Paper – I (Algebra & Geometry)

FIRST TERM (Algebra)

Unit 01: Integers **15 Lectures**

1.1 Well Ordering Principle for N. Principle of Mathematical induction (strong form).

1.2 Divisibility in Z: Definition and elementary properties. Division Algorithm, Euclidean Algorithm (Without proof) G.C.D. and L.C.M of integers, Relatively prime integers, Definition Prime numbers ,Euclid's lemma, Basic properties of G.C.D., G.C.D of any two integers a and b if it exists is unique and can be expressed in the form $ax + by$, where $x, y \in \mathbb{Z}$.

1.3 Equivalence Relations, Equivalences classes, properties of Equivalences classes, Definition of partition, every partition gives an equivalence relation and vice-versa, Definition of Congruence, Congruence as equivalence relation on $\mathbb{Z}$, Residue classes, Partition of $\mathbb{Z}$, Addition modulo n , Multiplication modulo n.

Unit 02: Polynomials **6 Lectures**

2.1 Definition of polynomial, Degree of polynomial, Algebra of polynomials, Division algorithm (without proof). G.C.D of two polynomials (without proof).

2.2 Remainder Theorem, Factor Theorem.

2.3 Relation between the roots and the coefficients of a polynomial, Examples.

Unit 03: Matrices and System of linear equations. 15 Lectures

3.1 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.

3.2 System of linear equations, Matrix form of system of linear equations, Homogeneous and non-homogeneous system of linear equations, Gauss Elimination and Gauss Jordan Method.

3.3 Consistency of a system of linear equations, condition of consistency (without proof).

3.4 Eigen values, Eigen vectors, characteristic equation of a matrix of order up to 3×3

3.5 Statement of Cayley Hamilton theorem and its use to find the inverse of a matrix.

SECOND TERM (Geometry)

Unit 04: Analytical Geometry of two dimensions: 10Lectures

4.1) Change of axes, Translation and rotation.

4.2) Conic Section: General equation of second degree in $x\ and\ y$. Centre of conic, Nature of conic, Reduction to standard form.

Unit 05: Planes in 3-dimension: 6 Lectures

Revision: Equations of the first degree in x, y, z, Transformation to the normal form, determination of plane under given conditions, Equations of the plane through three given points.

5.1 Systems of planes, two sides of a plane.

5.2 Length of the perpendicular from a point to a plane, bisectors of angles between two planes.

5.3 Joint equation of two planes, Angle between planes.

Unit 06: Lines in 3-dimension: 6 Lectures

Revision: Equations of a line, equations of a straight line in terms of its direction cosines and the co-ordinates of a point on it, equations of a line through two points, Symmetrical and unsymmetrical forms of the equations of a line. transformation of the equations of a line to the symmetrical form. Angle between a line and a plane.

6.1 The condition that a given line may lie in a given plane, the condition that two given lines are coplanar.

6.2 Number of arbitrary constants in the equations of a straight line, sets of conditions which determine a line.

6.3 The shortest distance between two lines, the length and equations of the line of shortest distance between two straight lines, length of perpendicular from a given point to a given line.

Unit 07: Sphere **8 Lectures**

7.1 Definition and equation of the sphere in various forms.

7.2 Plane section of a sphere, intersection of two spheres.

7.3 Equation of a circle, sphere through a given circle, intersection of a sphere and a line.

7.4 Equation of a tangent plane.

Unit 08: Cones and Cylinders: **6 Lectures**

8.1 Definition of cone and cylinder.

8.2 Equation of cone and cylinder with vertex at origin and (α, β, γ).

8.3 The right circular cone, equation of a right circular cone.

8.4 The right circular cylinder, equation of a right circular cylinder.

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

Reference Books:

1. Shantinarayan: Analytical Solid Geometry, S. Chand and Company Ltd, New Delhi, 1998.
2. David Burton, Elementary Number Theory, Tata McGraw Hill, Indian Edition.
3. H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Ed Wiley, (1994).
4. P.K.Jain and Khalil Ahmad,A Text Book of Analytical Geometry of Three Dimensions, Wiley Estern Ltd. 1999.
5. K.B.Datta, Matrix and Linear Algebra, Prentice hall of India Pvt.Ltd, New Delhi 2000.

AMG 1: Applied Mathematics General – I

(Calculus and Differential Equations)

FIRST TERM (Calculus)

Unit 1. The Real Numbers : 8 Lectures

1.1 Algebraic properties of $\mathbb{R}$,

1.2 Order properties of $\mathbb{R}$,Iintervals in$\mathbb{R}$, neighborhoods and deleted neighborhoods of a real number, bounded subsets of $\mathbb{R}$.

1.3 The Completeness Property of $\mathbb{R}$, denseness of $\mathbb{Q}$ in $\mathbb{R}$.

Unit 2.Limit and Continuity 10Lectures

2.1 $\epsilon - \delta$ definition of limit of a function, Basic properties of limits.

2.2 Continuity of function at a point, Types of discontinuity.

2.3 Continuous functions on intervals.

2.4 Properties of continuous functions on closed and bounded interval. (i) Boundedness. (ii) Attains its bounds. (iii) Intermediate value theorem

Unit 3. Differentiation 18Lectures

3.1 Definition of derivative of a real valued function at a point, notion of differentiability, geometric interpretation of a derivative of a real valued function at a point.

3.2 Differentiability of a function over an interval.

3.3 Statement of rules of differentiability, chain rule of finding derivative of composite of differentiable functions (without proof), derivative of an inverse function.

3.4.Mean Value Theorems: Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem

3.5 Indeterminate forms. L-Hospitals rule.

3.6 Higher order derivatives, examples, Leibnitz Theorem and its applications

3.7 Taylor's and Maclaurin's Theorem with Lagrange's form of remainder (without proof),Examples with assuming convergence of series.

SECOND TERM
(Differential Equations)

Unit 4. Integration 08 Lectures

4.1 Integration of rational function by using partial fraction.

4.2 Integration of some irrational functions:

$i) \int (ax+b)^{\frac{1}{n}} dx \; where \; n \; is \; a \; positive \; integer, \;\; ii) \int \frac{Ax+B}{\sqrt{ax^2+bx+c}} dx$

$iii) \int (Ax+B)\sqrt{ax^2+bx+c} \; dx$

4.3 Reduction formula

$i) \int \frac{x^n}{\sqrt{ax^2+bx+c}} \; dx \;\; ii) \int \frac{dx}{(x^2+a^2)n} \;\; , n \; is \; a \; positive \; integer \;\; iii) \int (x^2+a^2)^{n/2} \; dx$

$iv) \int_0^{\pi/2} sin^n x dx \;\; v) \int_0^{\pi/2} cos^n x dx$

Unit 5. Differential Equations of first order and first degree: 16 Lectures

5.1 Introduction to function of two, three variables, homogenous functions, Partial derivatives.

5.2 Differential equations, General solution of Differential equations.

5.3 Methods of finding solution of Differential equations of first order and first degree, Variable separable form, Homogenous Differential equations, Differential equations reducible to homogeneous form. Exact Differential equations.

Differential equations reducible to exact Differential equations, Integrating factors, Linear Differential equations. Bernoulli's Differential equations.

Unit 6. Application of Differential Equations : 06 Lectures

6.1 Orthogonal trajectories.

6.2 Kirchhoff's law of electrical circuit (RC & LR Circuit)

Unit 7. Methods of finding general solution of Differential Equations of first order and higher degree: 06 Lectures

7.1 Equations solvable for p.

7.2 Equations solvable for x.

7.3 Equations solvable for y.

7.4 Equation in Clairaut's form.

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

Reference Books:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002

2. Integral Calculus, Shantinarayan, S.K.Mittal, S. Chand and Co. Publication 2006.

3. R.Courant and F.John, Introduction to Calculus and Analysis, Vol. 1, Reprint of the first Ed., Sprinnger-Verlag,New York,1999.

4. Principles of Mathematical Analysis, W. Rudin, Third Edition, McGrawHill, 1976

5. Elementary Differential Equations, Macmillan Publication ,by Rainville and Bedient.

6. Ordinary and partial Differential equations,M.D. Raisingania, S. Chand and Company,2009.