K. C. E. Society's
Moolji Jaitha College

NAAC Reaccredited Grade - A (CGPA :3.15 - 3rd Cycle) |
UGC honoured "College of Excellence"
Dept. of Biotechnology, Ministry of Science & Technology honoured
"Star College" | DST(FIST) Assisted College

ESTD. 1945

के. सी. ई. सोसायटीचे
मूळजी जेठा महाविद्यालय

'स्वायत्त महाविद्यालय'
नॅकद्वारा पुनर्मानांकित श्रेणी - 'ए' (सी.जी.पी.ए. : ३.१५ - तिसरी फेरी)
विद्यापीठ अनुदान आयोगद्वारा घोषित 'कॉलेज ऑफ एक्सलन्स'
भारत सरकारच्या विज्ञान, तंत्रज्ञान, जैवतंत्रज्ञान विभागातर्फे
घोषित 'स्टार कॉलेज'। डी.एस.टी. (फीस्ट) अंतर्गत अर्थसहाय्य प्राप्त

Date :- 29/06/2019

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc./M. Sc. in Mathematics (Sem I & II)

Ref. :- Decision of the Academic Council at its meeting held on 28/06/2019.

The Syllabi of B. Sc./M. Sc. in Mathematics (First and Second Semesters) as per CBCS-UG/PG Regulations, 2016 and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2019-20.

Copy of the Syllabi shall be downloaded from the College Website (www.kcesmjcollege.in)

Chairmar
Board of Stud

Principal,
M. J. College, Jalgaon

To :

1) The Head of the Dept., M. J. College, Jalgaon.
2) The Director, School of Mathematical Sciences, M. J. College, Jalgaon.
3) The office of the COE, M. J. College, Jalgaon.
4) The office of the Registrar, M. J. College, Jalgaon.
5) Office File.

Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

An "Autonomous College" Affiliated to

KBC North Maharashtra University, Jalgaon

KNOWLEDGE IS POWER

ESTD. 1945

SYLLABUS STRUCTURE OF

B. Sc. Mathematics

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2019-20]

F. Y. B. Sc. Mathematics Course Structure

Term / Semester	Course Module	Subject code	Title of Paper	Credit	Hours per week
I	DSC	MTH-111	Calculus	2	2
	DSC	MTH -112	Coordinate Geometry	2	2
	DSC	MTH -113(A) OR MTH -113(B)	Matrix Algebra OR Applied Matrix Algebra	2	2
I I	DSC	MTH -121	Ordinary Differential Equations	2	2
	DSC	MTH -122	Theory of Equations	2	2
	DSC	MTH -123(A) OR MTH-123(B)	Numerical Analysis OR Numerical Methods	2	4

S. Y. B. Sc. Mathematics Course Structure

Term / Semester	Course Module	Subject Code	Title of Paper	Credit	Hours per Week
III	DSC	MTH -231	Calculus of several Variables	2	2
	DSC	MTH-232(A) OR MTH-232(B)	Abstract Algebra OR Computational Algebra	2	2
	DSC	MTH -233	Practical Course based on MTH-231 and MTH-232	2	4
	SEC	MTH -230	Set Theory and Logic	2	2
I V	DSC	MTH -241	Complex Variables	2	2
	DSC	MTH-242(A) OR MTH-242(B)	Differential Equations OR Applied Differential equations	2	2
	DSC	MTH -243	Practical Course based on MTH-241 and MTH-242	2	4
	SEC	MTH -240	Graph Theory	2	2

T. Y. B. Sc. Mathematics Course Structure

Term / Semester	Course Module	Subject Code	Title of Paper	Credit	Hours per Week
V	DSE	MTH -351	Metric Spaces	2	2
	DSE	MTH -352	Integral Calculus	2	2
	DSE	MTH -353	Modern Algebra	2	2
	DSE	MTH -354	Lattice Theory	2	2
	DSE	MTH -355(A) OR MTH-355(B)	Number Theory OR Quantitative Techniques	2	2
	DSE	MTH -356(A) OR MTH-356(B)	Vector Analysis OR C-Programming	2	2
	DSE	MTH -357	Practical Course based on MTH-351 and MTH-352	2	4
	DSE	MTH -358	Practical Course based on MTH-353 and MTH-354	2	4
	DSE	MTH -359	Practical Course based on MTH-355 and MTH-356	2	4
	SEC	MTH -350	Laplace Transforms	2	2
VI	DSE	MTH -361	Measure and Integration Theory	2	2
	DSE	MTH -362	Methods of Real Analysis	2	2
	DSE	MTH -363	Linear Algebra	2	2
	DSE	MTH -364	Ordinary and Partial Differential Equations	2	2
	DSE	MTH -365(A) OR MTH-365(B)	Optimization Techniques OR Integral Equations	2	2
	DSE	MTH -366(A) OR MTH-366(B)	Integral Transforms OR Dynamics	2	2
	DSE	MTH -367	Practical Course based on MTH-361 and MTH-362	2	4
	DSE	MTH -368	Practical Course based on MTH-363 and MTH-364	2	4
	DSE	MTH -369	Practical Course based on MTH-365 and MTH-366	2	4
	SEC	MTH -360	Applied Numerical Methods	2	2

Examination Pattern for the all Courses (40:10)

Nature	Marks
External Marks	**40**
Internal Marks	**10**
Total Marks	**50**

F. Y. B. Sc. Mathematics Syllabus
MTH-111: Calculus

Course Description: This course provides fundamental knowledge of limits and continuity, Differentiations, Mean value theorem, Rolle's theorem, Cauchy's Mean value theorem and Geometrical interpretations.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: The basic need of this course is to understand the concepts and applications of calculus. Also, this course will improve problem solving and logical thinking abilities of the students. By learning this course students can use the concepts of calculus to develop different mathematical models.

Learning Outcomes: Upon successful completion of this course the student will be able to:

a) understand basic concepts on limits and continuity.
b) understand use of differentiations in various theorems.
c) know the Mean value theorems and its applications.
d) make the applications of Taylor's, Maclaurin's theorem.
e) know the applications of calculus.

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Unit-1. Limits and Continuity: Hours-8, Marks-10

Epsilon-delta definition of limit of a function, Basic properties of limits, Indeterminate forms & L-Hospitals rule, Continuous functions. Properties of continuous functions on closed and bounded intervals, Theorems on Boundedness of continuous functions, including Intermediate value theorem, Uniform continuity.

Unit-2. Mean Value Theorems: Hours-7, Marks-10

Differentiability, Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Geometrical interpretation and applications.

Unit-3. Successive Differentiation: Hours-8, Marks-10

The nth derivative of some standard functions: e^{ax+b}, $(ax+b)^m$, x^m, $\frac{1}{ax+b}$, $\log(ax+b)$, $sin(ax+b)$, $cos(ax+b)$, $e^{ax}sin(bx+c)$, $e^{ax}cos(bx+c)$. Leibnitz's theorem & Examples.

Unit-4. Applications of Calculus: Hours-7, Marks-10

Taylor's theorem with Lagrange's form of remainder and related examples, Maclaurin' theorem with Lagrange's form of remainder and related examples, Reduction Formulae: 1) $\int_0^{\pi/2} sin^n x\,dx$ 2) $\int_0^{\pi/2} cos^n x\,dx$ 3) $\int_0^{\pi/2} sin^m x\,cos^n x\,dx$ 4) $\int_0^{\pi/2} \frac{sinnx}{sinx}dx$.

References:

1. Robert Wrede and Murray R. Spiegel, *Theory and Problems of Advanced Calculus*, McGraw-Hill Company, New York, Second Edition, 2002.
2. Gorakh Prasad, *Text Book on Differential calculus*, Pothishala Private Ltd., Allahabad, 1959.
3. Gorakh Prasad, *Integral calculus*, Pothishala Private Ltd., Allahabad.

MTH-112: Coordinate Geometry

Course Description: This course provides an elementary level knowledge of two-and three-dimensional geometries especially sphere, cone and cylinders.

Prerequisite Course(s): 11and 12 standard Mathematics.

General Objective: General objectives are to study two-dimensional geometry, translation and rotation of axes and its use to convert in standard 2-d forms. Also, to study three-dimensional geometry, Sphere, Cone and Cylinder along with their properties and interpretations.

Learning Outcomes:

Students can visualize geometrical concepts and draw two dimensional figures and can find their standard forms by shifting and rotation of axes. Students also can draw three dimensional figures and their equations particularly Sphere, Cone and Cylinder.

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Unit-1. Analytical Geometry: Hours-8, Marks-10

Change of axes, Translation and Rotation, Invariants, Conic section, General equation of second degree in two variables and its reduction to standard form.

Unit-2. Sphere : Hours-7, Marks-10

Equation of sphere in different forms. Plane section of sphere. Tangent line and Tangent plane to sphere. Condition of tangency and point of contact. Interpretation of $S + \lambda S = 0$ and $S + \lambda U = 0$ with usual notations.

Unit-3. Cone : Hours-8, Marks-10

Equation of cone with vertex at origin. Equation of cone with vertex at (α, β, γ). Right circular cone. Enveloping cone of sphere. Tangent line and tangent plane to the cone.

Unit-4. Cylinder : Hours-7, Marks-10

Definition and Equation of cylinder. Right circular cylinder. Enveloping cylinder.

References:

1. S. L. Loney, *The Elements of Co-ordinate Geometry*, MacMillan and company, London.
2. Gorakh Prasad and H.C. Gupta, *Text Book on Co-ordinate Geometry*, Pothishala Pvt. Ltd. Allhabad.
3. Shantinarayan, *Analytical Solid Geometry*, S. Chand & Co.
4. D. R. Sharma, *Solid Geometry*, Sharma Publications, Jalandhar, 30th Edition.[Unit-1]

MTH-113(A): Matrix Algebra

Course Description: This course provides fundamental knowledge of matrix theory.
Prerequisite Course(s): 11 and 12 standard Mathematics.
General Objective: The basic need of this course is to understand the concepts and applications of matrices. Also, this course will improve problem solving and logical thinking abilities of the students. By learning this course students can use the concepts of theory of matrices in linear algebra and numerical Analysis.
Learning Outcomes: Upon successful completion of this course the student will be able to:

a) Understand operations on matrices.
b) Understand the concept of rank of a matrix and inverse of a matrix.
c) To use theory of matrices in solving linear equations.
d) Understand the concept of eigen values and eigen vectors.
e) To use theory of matrices for solving linear system of equations by matrix inversion, Gauss elimination and Gauss Jordan method (3x3 system).

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Unit-1. Rank of Matrix: Hours-8, Marks-10

Elementary operations on matrices. Adjoint of a matrix & Inverse of a matrix. Existence & uniqueness theorem of inverse of a matrix. Properties of inverse of a matrix, Elementary matrices. Rank and normal form of a matrix, Reduction of a matrix to its normal form, Rank of product of two matrices.

Unit-2. System of Linear Equations: Hours-7, Marks-10

A homogeneous and non-homogeneous system of linear equations. Consistency of system of linear equations. Application of matrices to solve the system of linear equations.

Unit-3. Eigen Values & Eigen Vectors: Hours-8, Marks-10

Orthogonal matrices and properties of orthogonal matrices. Characteristic equation, Eigen values and Eigen vectors of matrices. Cayley Hamilton theorem (statement only) and its use to find the inverse of a Matrix.

Unit-4. Direct methods for solving linear system: Hours-7, Marks-10

Matrix inversion method (3x3 system), Gauss elimination method (3X3 system), Gauss Jordan method (3x3 system), III-conditioned linear systems.

References:

1. K. B. Datta, *Matrix and Linear Algebra*, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
2. Shanti Narayan, *A Text Book of Matrices*, S. Chand Limited, 2010.
3. Richord Bronson, *Schaum's Outline of Theory and Problems of MATRICES*, McGraw-Hill, New York, 1989.
4. Vince, John A., *Mathematics for Computer Graphics*, Springer-Verlag London, 2010.
5. Peter Shirley, A. K. Peters, *Fundamental of Computer Graphics*, Wellesley, Massachutusetts.
6. Zhigang Xiang and Roy A. Plastock, *Schaum's Outline of Computer Graphics 2/E 2nd edition*, Hall New Delhi, 2015.
7. Anthony J. Pettofrezzo, *Matrices & Transformation*, Dover Publications, Revised edition,1978.

MTH-113(B): Applied Matrix Algebra

Course Description: This course provides fundamental knowledge of matrix theory.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: The basic need of this course is to understand the concepts and applications of matrices. Also, this course will improve problem solving and logical thinking abilities of the students. By learning this course students can use the concepts of theory of matrices in linear algebra.

Learning Outcomes: Upon successful completion of this course the student will be able to:

a) Understand operations on matrices.
b) Understand the concept of rank of a matrix and inverse of a matrix.
c) To use theory of matrices in solving linear equations.
d) Understand the concept of eigen values and eigen vectors.
e) To use theory of matrices to Scaling & Shearing, Reflection, Rotation & Translation.

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Unit-1. Rank of Matrix: Hours-8, Marks-10

Elementary operations on matrices. Adjoint of a matrix & Inverse of a matrix. Existence & uniqueness theorem of inverse of a matrix. Properties of inverse of a matrix, Elementary matrices. Rank and normal form of a matrix, Reduction of a matrix to its normal form, Rank of product of two matrices.

Unit-2. System of Linear Equations: Hours-7, Marks-10

A homogeneous and non-homogeneous system of linear equations. Consistency of system of linear equations. Application of matrices to solve the system of linear equations.

Unit-3. Eigen Values & Eigen Vectors: Hours-7, Marks-10

Orthogonal matrices and properties of orthogonal matrices. Characteristic equation, Eigen values and Eigen vectors of matrices. Cayley Hamilton theorem (statement only) and its use to find the inverse of a Matrix.

Unit-4. Matrix Transformation: Hours-8, Marks-10

Two & Three-dimensional Matrix Transform. Application of matrices to Scaling & Shearing. Application of Matrices to Reflection, Rotation & Translation.

References:

1. K. B. Datta, *Matrix and Linear Algebra*, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
2. Shanti Narayan, *A Text Book of Matrices*, S. Chand Limited, 2010.
3. Richord Bronson, *Schaum's Outline of Theory and Problems of MATRICES*, McGraw-Hill, New York, 1989.
4. Vince, John A., *Mathematics for Computer Graphics*, Springer-Verlag London, 2010.
5. Peter Shirley, A. K. Peters, *Fundamental of Computer Graphics*, Wellesley, Massachutusetts.
6. Zhigang Xiang and Roy A. Plastock, *Schaum's Outline of Computer Graphics 2/E 2nd edition*, Hall New Delhi, 2015.

MTH-121: Ordinary Differential Equations

Course Description: This course provides fundamental knowledge of Ordinary Differential Equations and their applications.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: The basic need of this course is to understand the different methods of solving differential equations and their applications to solve problems arrives in engineering and technology.

Learning Outcomes: Upon successful completion of this course the student will be able to:

a) understand basic concepts in differential equations.
b) understand method of solving differential equations
c) understand use of differential equations in various fields.

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Unit-1. Differential equations of first order and first degree:

Hours-8, Marks-10

Partial derivatives of first order & second orders and Examples, Exact differential equations, Condition for exactness, Integrating factor, Rules for finding integrating factors, Linear differential equations, Bernoulli's Equation. Equation reducible to linear form.

Unit-2. Differential equations of first order and higher degree:

Hours-7, Marks-10

Differential equations of first order and higher degree, Equation solvable for p, Equation solvable for y, Equation solvable for x, Clairaut's form.

Unit-3. Linear differential equations of second and higher order:

Hours-8, Marks-10

Linear differential equations with constant coefficients, Complementary functions, Particular integrals of $f(D)y = X$, where $X = e^{ax}$, $\sin(ax)$, $\cos(ax)$, x^n, $e^{ax}V$, xV with usual notations.

Unit-4. Homogeneous linear differential equations: Hours-7, Marks-10

Homogeneous linear differential equations (Cauchy's differential equations), Example of Homogeneous linear differential equations, Equations reducible to homogeneous linear differential equations (Legendre's equations), Example of Equations reducible to homogeneous linear differential equations.

References:

1. D. A. Murray, *Introductory Course in Differential Equations*, Orient Congman (India) 1967.
2. G. F. Simmons, *Differential Equations*, Tata McGraw Hill, 1972.

MTH-122: Theory of Equations

Course Description: This course provides fundamental knowledge of Theory equations.
Prerequisite Course(s): 11 and 12 standard Mathematics.
General Objective: To study:

a) Divisibility of numbers and Roots of polynomial equations.
b) Relations between roots and coefficients of polynomials of degree ≤ 4.
c) Roots of cubic equations by using Cardon's method, biquadratic equations by Descarte's method and roots of polynomial equation s by Newton's method.

Learning Outcomes:
Students can find out roots of any equation of degree less than or equal to five. Theory of equations is highly useful in various subjects like algebra, linear algebra, calculus, ordinary and partial differential equations etc.

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Unit-1. Divisibility of Integers : Hours-8, Marks-10

Natural numbers, Well ordering principal (statement only), Principle of Mathematical Induction, Divisibility of integers and theorems, Division algorithm, GCD and LCM, Euclidean algorithm, Unique factorization theorem.

Unit-2. Polynomials: Hours-7, Marks-10

Revision of Polynomials, Horner's method of synthetic division, Existence and uniqueness of GCD of two polynomials, Polynomial equations, Factor theorem and generalized factor theorem for polynomials, Fundamental theorem of algebra (Statement only), Methods to find common roots of polynomial equation, Descarte's rule of signs, Newton's method of divisors for the integral roots.

Unit-3. Theory of Equations-I : Hours-8, Marks-10

Relation between roots and coefficient of general polynomial equation in one variable, Relation between roots and coefficient of quadratic, cubic and biquadratic equations. Symmetric functions of roots.

Unit-4. Theory of Equations –II : Hours-7, Marks-10

Transformation of equations, Cardon's method of solving cubic equations, Biquadratic equations, Descarte's method of solving biquadratic equations.

References:

1. David M. Burton, *Elementary Number Theory*, W. C. Brown publishers, Dubuquo lowa 1989.
2. H. S. Hall and S. R. Knight, *Higher Algebra*, H. M. Publications 1994.
3. K. B. Datta, *Matrix and Linear Algebra*, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
4. D. R. Sharma, *Theory of Equations*, Sharma Publications, Jalandhar.

MTH-123(A): Numerical Analysis

Course Description: This course provides fundamental knowledge of different Methods of solution of equations, basics of interpolation and curve fitting for set of data. Also, it provides methods for solving differential equations.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: The students will be able to understand the basic numerical analysis which is applicable to problems like finding of zeroes of algebraic equations, interpolation, curve fitting and solution of first order differential equations. Students will also understand that when exact solutions are difficult to obtain, then approximate solutions can be obtained by using numerical methods.

Learning Outcomes: Student will be able to:

a) understand basic concepts of methods of solutions of equations viz. bisection, iteration, Newton-Raphson methods and method of false position.
b) understand methods of curve fitting viz. Gauss's forward and backward difference formulae and Lagrange's interpolation formula.
c) use of curve fitting such as least square, polynomial and exponential fittings for set of given data.
d) use Taylor's series, Euler's method. Modified Euler's method., Runge Kutta methods for solving ordinary differential equations.

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Unit-1. Solution of Algebraic and Transcendental Equations: Hours-8, Marks-10

Errors and their computation, Absolute, relative and percentage errors, The Bisection method, The iteration method, The method of false position, Newton-Raphson method.

Unit-2. Interpolation with uniform intervals: Hours-7, Marks-10

Finite differences: Forward differences, backward differences, central differences, Symbolic relations and other difference operators, Gauss forward and backward interpolation by central differences, Stirling's formula.

Unit-3. Interpolation with unequal intervals: Hours-8, Marks-10

Divided differences and Properties, Newton's divided difference formula, Lagrange's interpolation, inverse interpolation by Lagrange's method and Iterative method.

Unit-4. Numerical Solutions of Ordinary Differential Equations: Hours-7, Marks-10

Numerical solution of first order ODE by Taylor's series, Euler's method and Modified Euler's method, Runge–Kutta method, Runge–Kutta second and fourth order formulae.

Recommended Book: V. N. Vedamurty and N. Ch. S. N. Iyengar, *Numerical Methods*, Vikas Publishing House, India, 1995.

References:

1. S. S. Shastry, *Introductory Methods of Numerical Analysis*, Prentice Hall India Learning Private Limited; Fifth edition, 2012.
2. Carl-Erik Froberg, *Introduction to Numerical Analysis*, Addison-Wesley, Second edition, 1979.
3. M. K. Jain, S. R. K. Iyenger and R. K. Jain, *Numerical methods for scientific and engineering computation*, New Age International Publisher Pvt. Ltd.,1999.

MTH-123(B): Numerical Methods

Course Description: This course provides fundamental knowledge of different Methods of solution of equations, basics of interpolation and curve fitting for set of data. Also, it provides methods for solving differential equations.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective: The students will be able to understand the basic numerical analysis which is applicable to problems like finding of zeroes of algebraic equations, interpolation, curve fitting and solution of first order differential equations. Students will also understand that when exact solutions are difficult to obtain, then approximate solutions can be obtained by using numerical methods.

Learning Outcomes: Student will be able to:

a) understand basic concepts of methods of solutions of equations viz. bisection, iteration, Newton-Raphson methods and method of false position.
b) understand methods of curve fitting viz. Gauss's forward and backward difference formulae and Lagrange's interpolation formula.
c) use of curve fitting such as least square, polynomial and exponential fittings for set of given data.
d) Fit curves of straight line, power function $y = ax + c$, polynomial of degree two $y = a + bx + cx^2$, exponential function $y = ae^{bx}$.

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Unit-1. Solution of Algebraic and Transcendental Equations: Hours-8, Marks-10

Errors and their computation, Absolute, relative and percentage errors, The Bisection method, The iteration method, The method of false position, Newton-Raphson method.

Unit-2. Interpolation with uniform intervals: Hours-7, Marks-10

Finite differences: Forward differences, backward differences, central differences, Symbolic relations and other difference operators, Gauss forward and backward interpolation by central differences, Stirling's formula.

Unit-3. Interpolation with unequal intervals: Hours-8, Marks-10

Divided differences and Properties, Newton's divided difference formula, Lagrange's interpolation, inverse interpolation by Lagrange's method and Iterative method.

Unit-4. Curve Fitting: Hours-7, Marks-10

Least squares curve fitting procedures, Fitting of straight line, Non-linear curve fitting: power function $y = ax + c$, Fitting of polynomial of degree two $y = a + bx + cx^2$, Fitting of exponential function $y = ae^{bx}$.

Recommended Book: V. N. Vedamurty and N. Ch. S. N. Iyengar, *Numerical Methods*, Vikas Publishing House, India, 1995.

References:

1. S. S. Shastry, *Introductory Methods of Numerical Analysis*, Prentice Hall India Learning Private Limited; Fifth edition, 2012.
2. Carl-Erik Froberg, *Introduction to Numerical Analysis*, Addison-Wesley, Second edition, 1979.
3. M. K. Jain, S. R. K. Iyenger and R. K. Jain, *Numerical methods for scientific and engineering computation*, New Age International Publisher Pvt. Ltd.,1999.