

B.Sc. (Hons.) MATHEMATICS SYLLABUS 2018 BATCH
(UPDATED ON 24.05.2019)

Differential Equations– I

Subject Code- BMAT1-307

L T P C

4 1 0 5

Time Allowed: 3 hours

University Exam: 60

Internal Assessment: 40

Total: 100

UNIT-I

Elementary Methods in Ordinary Differential Equations, Formation of a differential equation, Solutions: General, particular, and singular, First order exact equations and integrating factors, Degree and order of a differential equation, Equations of first order and first degree, Equations in which the variable are separable, Homogeneous equations, Linear equations and equations reducible to linear form.

UNIT-II

First order higher degree equations solvable for x , y , p . Clairaut's form and singular solutions, Orthogonal trajectories, Linear differential equations with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order.

UNIT-III

General solution of homogeneous equation of second order, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

UNIT-IV

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Series solutions of Bessel equation and Legendre equation, Bessel function and their Integral expression & recurrence relations, Legendre Polynomials, Rodrigue's formula, Recurrence relations, generating functions and orthogonal properties.

Recommended books:

1. W.E.Boyce and P.C.Diprima : Elementary Differential Equations and Boundary value problems, John Wiley, **1986**.
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover, **1956**.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

B.Sc. (Hons.) MATHEMATICS SYLLABUS 2018 BATCH
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MATHEMATICAL STATISTICS

Subject Code- BMAT1-308

L	T	P	C
4	1	0	5

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

UNIT-I

Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem, Random variable, function of random variable and their distributions, probability mass function, probability density function, cumulative distribution function.

UNIT-II

Concept of random variables and probability distributions: Two dimensional random variables, Joint, Marginal and conditional distributions, Independence of random variables, Expectation, Conditional expectation, Moments, Product moments, Probability generating functions, Moment generating function and its properties.

UNIT-III

Study of various discrete and continuous distributions: Binomial, Poisson, Negative binomial distributions.

UNIT-IV

Concept of sampling distribution and its standard error, Derivation of sampling distributions of Chi-square, t and F distribution of sample mean and variance Testing of hypotheses, fundamental notions important tests based on normal distributions, Tests of significance: tests based on normal distribution, Chi-square, t and F statistic.

Recommended Books:

1. R.V. Hogg & Craige, 'Introduction to Mathematical Statistics', 7th Edn., 2005
2. S.C. Gupta, V.K. Kapoor, 'Fundamental of Mathematical Statistics', 7th Edn., S. Chand, 1990.
3. Goon, Gupta and Das Gupta, 'Fundamentals of Statistics', 5th Edn., World Press, 1975.
4. V.K. Rohatgi, 'Introduction to Probability Theory & Mathematical Statistics', 2009.
5. Goon, Gupta and Das Gupta, Fundamentals of Statistics, Edition, Publisher, World Press, 1975.

B.Sc. (Hons.) MATHEMATICS SYLLABUS 2018 BATCH
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Geometry (Co-ordinate and Solid)

Subject Code- BMAT1-309

L T P C

4 1 0 5

Time Allowed: 3 hours

University Exam: 60

Internal Assessment: 40

Total: 100

Section-A

Transformation of axes, Shifting of origin, Rotation of axes, Reduction of the second degree equation into standard forms by transformation of co-ordinates, Intersection of three planes, Condition for three planes to intersect in a point or along a line or to form a prism.

Section-B

Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z , Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, Right circular and elliptic cones.

Section-C

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms.

Section-D

Sphere, Section of a sphere by a plane, Spheres of a given circle, Intersection of a line and a sphere, Tangent line, Tangent plane, Power of a point w.r.t. a sphere, Radical planes.

Books Recommended

1. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry.
2. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
4. Kreyszig, E.: Advanced Engineering Mathematics.
5. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry

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Number Theory

Subject Code- BMAT1-310

L T P C

4 1 0 5

Time Allowed: 3 hours

University Exam: 60

Internal Assessment: 40

Total: 100

Section-A

Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, Fundamental theorem of arithmetic, infinitude of primes, Distribution of primes, twin primes, Goldbach conjecture, Fermat primes.

Section-B

Modular arithmetic, Basic properties of congruence's, linear congruence's, Simultaneous linear congruence's, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem.

Section-C

Arithmetic modulo p , Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

Section-D

Greatest integer function, τ and σ functions, Mobius Inversion formula, Euler's Phi function, Euler's theorem, some properties of the Phi Function.

Books Recommended:

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
2. Niven and Zuckerman: An Introduction To Number Theory.
3. T.M. Apostol, 'Introduction to Analytic Number Theory', Springer.
4. Paul T. Bateman, 'Analytic Number Theory', World scientific.
5. H. Rosen Kenneth, 'Elementary Number Theory', 6th Edn.
6. G.H. Hardy, 'An Introduction to the Theory of Numbers', 6th Edn.

B.Sc. (Hons.) MATHEMATICS SYLLABUS 2018 BATCH
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OBJECT ORIENTED PROGRAMMING LANGUAGE USING C++

Subject Code- BCAP1-305

L	T	P	C
3	0	0	3

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

UNIT- I

Characteristics of Object Oriented Programming: Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, Code Extensibility and Reusability, User defined Data Types. Introduction to C++: Identifier, Keywords, Constants, And Operators: Arithmetic, relational, logical, And conditional and assignment. size of operator, Operator precedence and associativity.

UNIT- II

Classes and Objects: Class Declaration and Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control. this pointer. Objects: Object as function arguments, array of objects, functions returning objects, Const member functions.

Constructors and Destructor: properties, types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes, Virtual destructors. Destroying objects. Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested and container classes.

UNIT- III

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class. Types of Inheritance: Single, Multiple, Multilevel and Hybrid. Types of base classes: Direct, Indirect, Virtual, Abstract. Code Reusability.

UNIT- IV

Polymorphism and Operator Overloading: Methods of achieving polymorphic behavior. Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class. Introduction to File Handling.

Recommended Books:

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGraw Hill.
2. Deitel and Deitel, 'C++ How to Program', Pearson Education.
3. Herbert Schildt, 'The Complete Reference C++', Tata McGraw Hill.
4. Robert Lafore, 'Object Oriented Programming in C++', Galgotia Publications.
5. Bjarne Stroustrup, 'The C++ Programming Language', Addison-Wesley Publication Co.
6. Stanley B. Lippman, JoseeLajoie, 'C++ Primer', Pearson Education, 2002.

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SOFTWARE LAB (BASED ON C++)

Operational Knowledge and Implementation of numerical methods & statistical Techniques using C++ Language.

Differential Equations– II

Subject Code- BMAT1-410

L	T	P	C
4	1	0	5

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

Section-A

Formation of partial differential equations, PDEs of the first order, Lagrange's method, determination of integral surfaces of linear first order partial differential equations passing through a given curve, surfaces orthogonal to given system of surfaces, non-linear PDE of first order, Cauchy's method of characteristic, compatible system of first order PDE, Charpit's and Jacobi's general method of solution.

Section-B

Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Characteristic curves of the second order PDE, Monge's method of solution of non-linear PDE of second order.

Section –C

Method of Solution: Separation of variables in a PDE, Laplace, wave and diffusion equations, Elementary solutions of Laplace equations.

Section –D

The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions, one dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

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Recommended books:

1. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, 2003.
2. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011
3. Elements of Partial Differential Equation (3rd edition) – I. N. Sneddon, McGraw Hill Book Company, 1998.
4. Partial Differential Equations (2nd edition) – E. T. Copson, Cambridge University Press, 1995.
5. J.N. Sharma and K. Singh, Partial differential equations for engineers and scientists, 2nd Edition, Narosa Publication House, New Delhi, 2009
6. Sankara Rao, Introduction to partial differential equations, PHI,2010.

LINEAR ALGEBRA

Subject Code- BMAT1-411

L	T	P	C	University Exam: 60
4	1	0	5	Internal Assessment: 40
Time Allowed: 3 hours				Total: 100

UNIT-I

Vector spaces, Subspaces, algebra of subspaces, Quotient spaces, linear combination of vectors, Linear span, linear independence, Basis and dimension, dimension of subspaces.

UNIT-II

Linear transformations, Range, Null space, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, algebra of linear transformations.

UNIT-III

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

UNIT-IV

Isomorphisms, Isomorphism theorems, Invertibility and Isomorphisms, Change of coordinate matrix.

Books Recommended

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1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

MECHANICS

Subject Code- BMAT1-412

L	T	P	C
4	1	0	5

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

UNIT-I

Generalized coordinates, Holonomic and non-holonomic systems scleronomic and rhenomic systems, Generalized potential, Lagrange's equation of first kind and second kind uniqueness of solution.

UNIT-II

Hamilton canonical equation, cyclic coordinates, Routh's equation, Poisson bracket, Poisson's identity, Jacobi -Poisson theorem, Hamilton's principle, Principle of least action.

UNIT-III

Small oscillations of conservative system, Lagrange's equation for small oscillations, Nature of roots of frequency equation, Principle oscillations. Normal coordinates, Canonical transformations, Hamilton- Jacobi equation.

UNIT-IV

Method of separation of variables, Lagrange's bracket condition of Canonical character of transformation in terms of Lagrange's bracket and Poisson's Bracket.

Recommended Books

1. F. Gantmacher, 'Lectures in Analytic Mechanics', Mir Publisher, Moscow, 1975.
2. H. Goldstien, C. Ppoole and J.L. Sofco, 'Classical Mechanics', 3rd Edn., Addison Wesley, 2002.
3. L.D. Landau and E.M. Lipshitz, 'Mechanics', Pergamon Press, Oxford, 1976.
4. J.E. Marsden, 'Lectures on Mechanics', Cambridge University Press, 1992.

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NUMERICAL METHODS

Subject Code- BMAT1-413

L	T	P	C
4	1	0	5

University Exam: 60

Internal Assessment: 40

Time Allowed: 3 hours

Total: 100

UNIT-I

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss Jacobi, Gauss-Siedel and SOR iterative methods.

UNIT-II

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

UNIT-III

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

UNIT-IV

Taylor series and Picard's methods, Euler and modified Euler methods, Runge-Kutta methods, Predictor-Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, 1980.
4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., 2001.

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LATEX and R

Subject Code- BCAP1-407

L	T	P	C	University Exam: 60
3	0	0	3	Internal Assessment: 40
Time Allowed: 3 hours				Total: 100

Unit-I

Introduction to Latex, Typical Latex input file, Basic Conventions: Spacing, Line breaking, page breaking, Modes and Environments, Forbidden characters.

Unit II

Basic tools for Formatting text: Structuring, Changing Fonts, Paragraph Justification etc

Unit III

Producing Mathematical Formulae using Latex: Mathematical Mode, Characters in Mathematical Mode, Superscripts and Subscripts, Greek letters, Mathematical Symbols and formulae, Changing the mathematical style, Matrices, arrays and tables in Latex

Unit IV

Introduction and preliminaries of R : R commands, R and Statistics, Simple manipulations: numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and Matrices, Lists and Data frames

Recommended books:

1. Leslie Lamport, **Latex: A document preparation system**, User's guide and reference manual, 2nd ed., 1994, Addison Wesley
 2. F. Mittelbach, M Goosens, Johaas Braams, D Carlisle, Chris Rowley, **Latex Companion**, 2nd ed., 2004, Addison-Wesley Professional
 3. Norman Matloff, **The art of R programming**: no starch press
 4. W.N Venables and B.D Ripley: **Modern Applied Statistics with S**, Springer – Verlag 4th ed.
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LATEX and R LAB

Subject Code- BCAP1-408

L	T	P	C
0	0	2	1

1. Writing articles with Latex
 - 1.1 Creating latex file
 - 1.2 Writing mathematical symbols in text
 - 1.3 Creating arrays and matrices
 - 1.4 Writing references using latex
 - 1.5 Presentation of articles using beamer class

2. Programming with R

- 2.1 Loops and vectorization
- 2.2. Writing a program in R
- 2.3. Creating own functions
- 2.4. Using R in Statistics

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