B.A (Sem -I)

BA105 : ALGEBRA AND TRIGONOMETRY (MAJOR)

Pass percentage: 35%
Time allowed : 3hours.

External Evaluation: 70
Internal Evaluation: 30

<u>Course objective</u> : The objective of the course is to help the students acquire skills to do calculations like finding roots of a polynomial using different methods, solving simultaneous linear equation system and solving problems related to trigonometry with ease.

<u>Course learning outcomes:</u> On completion of course, the student will be able to

CO-I: Understand DeMoivre's theorem and apply it to solve numerical problems.

CO-II: Understand exponential, logarithmic ,hyperbolic functions of a complex variable.

CO-III: Understand how to find Eigen-values ,Eigen-vectors of a matrix and characteristic equation of a matrix and Diagonalization of matrices.

CO-IV : Understand rank of the matrix and use it to recognize consistent and inconsistent system of linear equations using row echelon form of the matrices.

INSTRUCTIONS FOR THE PAPER-SETTER/EXAMINER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eleven short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 12 marks and Section C will be of 22 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION:A

D'Moivre's theorem and its application including primitive nth root of unity, Expansions of $\sin n\theta$, $\cos n\theta$, $\sin^n\theta$,$\cos^n\theta$ (n $\in$ N). The exponential, logarithmic, circular and hyperbolic functions. Relation between the roots and coefficients of a general polynomial in

One variable ,Transformation of equation, solutions of cubic equations using cardon's method, solutions of bi -quadratic equation using Descarte's method.

SECTION:B

Hermitian and skew- Hermitian matrices, Elementary operations on matrices, linear independence and dependence of row and column vectors, row rank, column rank and rank of a matrix and their equivalence, Normal form of a matrix, Theorems on consistency of a system of linear equations (both homogeneous and non homogeneous). Eigen-values, Eigen-vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix, Diagonalization.

Books Recommended:

1. K.B. Datta :Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

2. S.R .Knight and H.S. Hall : HigherAlgebra,H.M.Publications,1994.

3. R.S.Verma and K.S.Shukla: TextBook onTrigonometry ,Pothishala Pvt. Ltd., Allahabad.

4. Shanti Narayan and P.K .Mittal: A TextBook of Matrices, S. Chand &Co., NewDelhi, Revised Edition, 2007.

5. C.Prasad, Textbook on Algebra and theory of equations, Pothishala Pvt. Ltd., Allahabad.

BA124: Mathematics Based Practicals

Course Objectives:

- Introduce students to mathematics-based software
- Enable plotting of graphs for various functions using software
- Plot straight lines and represent conics as sections of a cone
- Develop understanding of basic mathematical concepts
- Learn applicability of software in solving mathematical problems

Assessment:

Theory: 100marks
External:70(50 theory+20 Viva),   Internal:30
Time allowed: 1.5 hours

Course Outline:

Section A: Functions

- Domain and range of standard functions
- Trigonometric functions

Section B: Straight Lines and Conic Sections

- Straight lines
- Conic sections
- Equation of a circle

Practicals:

- Plot graphs of functions such as: $\sqrt{(ax+b)}$, $e^{(ax+b)}$, $\sin(ax+b)$
- Plot the general equation of a straight line
- Show conics as sections of a cone
- Draw circles when: Center and radius are given, or Center and a point on the circle is given

References:

- NCERT Mathematics Textbooks – Class XI &XII

B.A (Sem –II)

BA205 : CALCULUS (MAJOR)

Pass percentage: 35%
Time allowed : 3hours.

External Evaluation: 70
Internal Evaluation: 30

__Course objective__: The objective of the course is to help the students acquire skills to understand concepts of limits and continuity of a function geometrically and geometrical interpretation of various mean value theorems with their applications.

__Course learning outcomes:__ On completion of course , the student will be able to

__CO-I:__ understand Concavity, Convexity and points of Inflexion of a curve.

__CO-II:__ learn basic properties of limits, infinite limits, indeterminate forms.

__CO-III:__ understand Continuous functions, types of discontinuities, Continuity of composite functions ,Uniform continuity

__CO-IV:__ Understand Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, their geometric interpretation and applications.

__CO-V:__ Understand Taylor's theorem and Maclaurian theorem with various forms of remainder and their applications

INSTRUCTIONS FOR THE PAPER-SETTER /EXAMINER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eleven short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 12 marks and Section C will be of 22 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION:A

__Limits__: ε -δ definition of the limit of a function, basic properties of limits, infinite limits, indeterminate forms.

__Continuity__: Continuous functions, types of discontinuities, continuity of composite functions, sign of a function in a neighborhood of a point of continuity, intermediate value theorem, maximum and minimum value theorem

Concavity and convexity, points of inflexion, asymptotes

SECTION : B

__Mean value theorems__: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, their geometric interpretation and applications, Taylor's theorem, Maclaurin's theorem with various form of remainders and their applications

Hyperbolic, inverse hyperbolic functions of a real variable and their derivatives, Successive differentiation, Leibnitz's theorem and its applications

Books Recommended:
1. J. D. Murray & M . R. Spiegel : Theory and Problems of Advanced Calculus, Schaum's Outline Series, Schaum Publishing Co., New York.
2. Gorakh Prasad : Differential Calculus, Pothishala Private Ltd., Allahabad.
3. G.B. Thomas & R.L. Finney : Calculus and Analytic Geometry (Ninth Edition), Pearson Publication. 4.Shanti Narayan and P.K. Mittal : Differential Calculus, Edition 2006, S. Chand &Co., New Delhi.

BA224 : Numerical Analysis (SEC)

Time Allowed: 3hrs

External Exam: 70(50theory+20 viva)
Internal Assessment: 30
Total: 100

Course Outcomes:

CO1 To develop skills to solve mathematical problems using numerical methods.
CO2 Student will be able to use numerical techniques to find roots of non linear equations.
C03 Student will be able to analyse and estimate the errors in numerical solutions.
CO4 Will develop critical thinking skills to choose appropriate numerical method
COS Will use C/C++ Language to write and perform programs of Numerical Methods

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of two sections: Section A and B will have eight questions from entire syllabus with each question carrying 10 marks. Section C will be compulsory with 5 short-answer type questions of 02 marks each which will cover the entire Syllabus.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any four questions from both sections A and B and compulsory question of Section C

Section A

Propagation of error. Numerical cancellation and computation of functions. Arithmetic Expressions. Numbers, operations and elementary functions.

Section B

Numerical stability, and interval arithmetic. Linear and Non-linear equations: Bisection method. Regula falsi method, Secant method, Newton Raphson method.

References

1. Arnold Neumaier: Introduction to Numerical Analysis, Cambridge University Press, 2001.

2. Carl Erik Froberg: Introduction to Numerical Analysis, 2nd Edition. Addison Wesley Publishing Company, 1969.

3. Elements of Numerical Analysis: R.S. Gupta, Macmillan India Limited, 2009.

B.A (Sem –III)

BA305 : ADVANCED CALCULUS (MAJOR)

Pass percentage: 35%
Time allowed : 3hours.

External Evaluation: 70
Internal Evaluation: 30

Course objective: The objective of the course is to help the students acquire skills to understand concepts of limits, continuity and differentiability of a functions of two variables and study the concept of double and triple integration along with applications.

Course learning outcomes: On completion of course , the student will be able to

CO-I: Understand Archimedean and ordered property of real numbers.

CO-II: Understand limits, continuity and differentiability of a functions of two variables.

CO-III: Understand Applications of Euler's theorem on homogeneous functions.

CO-IV: Understand maxima and minima of functions of two or three variables and concept of constrained optimization.

CO-V: Understand Taylor's theorem and Maclaurian theorem with various forms of remainder and their applications

CO-VI: Understand the concept of double and triple integration along with applications.

INSTRUCTIONS FOR THE PAPER-SETTER /EXAMINER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eleven short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 12 marks and Section C will be of 22 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION:A

Properties of real numbers: Order property of real numbers ,bounds l.u.b. and g.l.b.,order completeness property of real numbers, Archimedean property of real numbers. Limit and Continuity of functions of several variables, Differentiability of real valued function of two variables, Partial differentiation, Jacobians and their properties, Schwarz's and Young's theorems, Euler's theorem on homogeneous functions.

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SECTION : B

Taylor's theorem for functions of two variables, Maxima and Minima, Langrange's multiplier method for functions of several variables. Double and Triple integrals, Change of order of integration in double integrals, Change of variables, Applications to evaluation of areas and volume, Centre of gravity and Moments of inertia.

Books Recommended:
1. Malik and Arora: *Mathematical Analysis*, New Academic science ,2017.
2. R.K Jain and S.R.K Iyenger: *Advanced Engineering Mathematics*, Narosa Publishing House.
3. G.B. Thomas & R.L. Finney : *Calculus and Analytic Geometry (Ninth Edition)*, Pearson Publication.

B. A (Sem –IV)

BA405: ANALYSIS (MAJOR)

Pass percentage: 35%
Time allowed : 3hours.

External Evaluation: 70
Internal Evaluation: 30

Course objective: The objective of the course is to help the students acquire skills to understand concepts of sequences and infinite series of real numbers and study the concept of Riemann integration along with improper integrals.

Course learning outcomes: On completion of course , the student will be able to

CO-I: Understand convergence and divergence of sequence of real numbers.

CO-II: Understand convergence and divergence of infinite series of real numbers.

CO-III: Understand Applications of various tests to check convergence and divergence of infinite series.

CO-IV: Understand the concept of Riemann Integration and conditions for Riemann Integrability.

CO-V: Understand Integration of unbounded functions via improper integrals.

CO-VI: Understand Applications of various tests to check convergence and divergence of Improper integrals.

INSTRUCTIONS FOR THE PAPER-SETTER /EXAMINER
The question paper will consist of three sections A, B and C. Sections A and B will have

four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eleven short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 12 marks and Section C will be of 22 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION:A

Sequences: Definition of sequence, Bounded and Monotonic Sequences , Convergence and Divergence of sequence, Cauchy's Convergence criterion for convergence of sequences.
Infinite Series: Definition of series ,Positive term series, Comparison Tests, Cauchy's root Test, Alternating series, Leibnit'z Test, D'Alembert's Ratio Test ,Raabe's Test, Logarithmic Test, Gauss Test, Cauchy's Integral test ,Absolute and Conditional convergence, Determination of radius of convergence of power series.(All tests without proofs only applications)

SECTION : B

Riemann Integration: Definition and existence of integrals, Upper and Lower sums, Upper and Lower integrals, Darboux theorem, Conditions of Integrability, Integrability of continous and monotone functions, First and Second mean value theorems, Fundamental Theorem on Integral Calculus.
Improper Integrals: Definition, Statements of their conditions of existence, Tests for convergence of Improper integrals, Beta and Gamma functions and their convergence.

Books Recommended:
1. Malik and Arora: *Mathematical Analysis , New Academic science ,2017.*
2. Shanti Narayan: *Differential and Integral calculus,*
3. G.B. Thomas & R.L. Finney : *Calculus and Analytic Geometry (Ninth Edition), Pearson Publication.*
4. Walter Rudin: *Principles of Mathematical Analysis.*