DEPARTMENT OF MATHEMATICS
TRIPURA UNIVERSITY

B.A./B.Sc.
MATHEMATICS
General & Honours
Syllabus
2014

PREAMBLE

From the Academic Session 2014-2015 Tripura University converted the UG course into Semester system. On this circumstance we revised the previous syllabus.

There will be 6 Semesters in place of 3 year course (part-I, II & III).

In the UG course of Mathematics there will be total 600 marks for General and 800 marks for Honours Course. In each course/paper of 80 marks (20 Internal assessment) there will be 4 distinct unit of each 20 marks. In case of each course/paper of 40 marks there will be 2 distinct units. There will be no MCQ type of questions in honours papers and in case of general courses in the paper having practical component.

In general course/paper without practical component there will be 40 marks MCQ and 40 marks subjective.

In B.Sc. General in Mathematics course in each semester will be 1 paper, 5^{th} paper in Semester-V have practical component and 6^{th} paper in Semester-VI will be Project. In B.Sc. Honours there will be 1 paper in each semester of I, II, III and IV, in 5^{th} and 6^{th} semester there will be 2 papers in each semester, 8^{th} paper is the practical paper.

In IMD, the course will be same as B.Sc. General Course and for IMD in Mathematics the syllabus will be as that of B.Sc. Honours.

B.A. / B. Sc. Semester-V (General)
MATHEMATICS
Paper-V
Mark : 50(Theory)+50(Practical)=100
Theory Mark : 10+40=50

Unit-I(20)
Numerical analysis

1. Approximate numbers and significant figures, rounding off numbers. Error and Absolute, relative and percentage errors. Linear operation, Difference, finite difference interpolation. Lagrange interpolation. Newton's forward and backward difference formula. Differentiation formula based on Newton's forward and backward difference formula. Numerical integration, deduction of Trapezoidal, Simpson's 1/3 rule from Newton's forward difference formula.
2. Solution of algebraic and transcendental equations: Bisection, Secent/Regula Falsi, Newton's-Raphson method, iteration method.
3. Solution of linear equations: Gause elimination, Gause-Jordan method. LU Decomposition. Inversion of 3 ×3 non-singular matrices by Gause elimination and Gause-Jordan method.

Refernces:

1. Numerical Analysis-S.A.Mollah, New Central Book Agency.

Unit-II(20)
Computer Science

1. Introduction to ANSI-C : Character set in ANSI-C. Key words: int, char, float, while etc. Constant and Variables, expressions, assignment statements, formatting source files. Header files.Data types, declarations, different types of integers, different kinds of integer constants, floating-point types, initialization, standard input/output, finding address of an object.
2. Operations and expressions, precedence and associatively, unary plus and minus operators, binary arithmetic operators, arithmetic assignment operators, increment and decrement operators, comma operator, relational operators, logical operators.
3. Control flow, conditional and unconditional bracing, looping, nested loops. if-else, do-while, for, switch, break, continue, goto statements etc., Infinite loops.

Arrays and Pointers

References:

1 Programming in ANSI-C-E.Balaguruswami, Tata MacGrawHill.
2 Let Us C- Kanethkar,BPB Pub.

Practical(40)

(Practical-Simple C-Programming and Numerical analysis through C programming):

(Laboratory Work Book:5,Viva-Voci-5, C-Programming-30)

1. Ascending / Descending order. Finding Largest / smallest.
2. Sum of finite series. Mean and variance.
3. Conversion of binary to decimal and decimal to binary.
4. Checking whether a number is prime or not. Generation prime numbers.
5. Solution of Quadratic equation. Newtone-Raphson's method. Lagrange interpolation.
6. Bisection method. Newton-Raphson method.
7. Trapezoidal Rule. Simpson's 1/3 rule.
8. Value of Determinant.
9. Cramer's Rule (for two variables).
10. Matrix addition, subtraction, transposition.

B.A. / B. Sc. Semester-VI (General)
MATHEMATICS
Paper-VI
PROJECT
Mark : 20+80=100

This paper is a Dissertation paper. Each student will select an advanced topic in Mathematics and undergo critical study under the guidance of a teacher. At the end of semester he/she will submit his study note book (40-50 pages). He/she will deliver an open power point presentation and will face questions from the teachers and spectators on his topic during his/her presentation.

Mark Distribution:
Internal assessment: 20
Dissertation note book: 20
Power point presentation: 40
Viva:20
Total:100

B.A. / B. Sc. Semester-V (Honours)
MATHEMATICS
Paper-V
Mark : 20+80=100

Unit-I(20)
(Analysis-I)

1. Bounded subset of R, L.U.B. (supremum) and G.L.B. (infimum) of a set. Least upper bound axiom. Characterization of R as a complete ordered field. Definition of an Archimedean ordered field. Archimedean property of R. Q is Archimedean ordered field but not ordered complete. Neighbourhood of a point. Interior point. Open set. Union, intersection of open sets. Limit point and isolated point of a set. Bolzano-Weierstrass. Complement of open set and closed set. Dense set in R.

2. Covering and compactness, Heine Borel theorem. Sequences of real numbers : Bounded sequence. Convergence and divergence. Examples. Every convergent sequence is bounded and limit is unique.

3. Monotone sequences and their convergence. Sandwich rule. Nested interval theorem. Cauchy's first and second limit theorems. Subsequence. Subsequential limits. Lim sup upper (limit) and lim inf (lower limit) of a sequence using inequalities. Bolzano-Weierstrass theorem for sequence. Cauchy's general principle of convergence

Unit-II(20)
(Analysis-II)

1 Riemann integration on [a,b] . Riemann approach Riemann sum and Riemann integrability. Darbaux's approach: upper sum U(P,f) and lower sum L(P,f), upper and lower integral, Darboux's theorem, necessary and sufficient condition of Riemann integrability. Equality of Riemann and Darboux's approach.

2 R-integrability of sum, product and quotient. R-integrability of $f \Rightarrow$ R-integrability of $|f|$. Integrability of monotone functions, continuous functions, piecewise continuous functions, function having (i) finite number of point of discontinuities, (ii) having finite number of limit points of discontinuities.

3 Function defined by the definite integral $\int_a^x f(t)dt$ and its properties. Primitives or indefinite integrals. First mean value theorem of integral calculus. Second mean value theorem of integral calculus (both Bonet's and Weierstrass's forms).

Unit-III(20)
(Analysis-III)

1. Improper integrals and their convergence, absolute and non-absolute convergence. Tests of convergence: Comparison test, m-test. Abel's and Dirichlet's test for convergence of integral of a product.

2. Beta and Gamma functions and their convergence, their properties and interrelation.

3. Geometric interpretation of definite integral. Fundamental theorem of integral, area enclosed by plane curves. Rectification of plane curves. Volume and surface area of solid formed by revolution of plane curves and areas about x-axis and y-axis.

Unit-IV(20)
(Analysis-IV)

1. Sequence and sequence of functions, pointwise and uniform convergence, boundness and continuity, integrability and differentiability of limit function in case of uniform convergence. Weierstrass M-test of uniform and absolute convergence. Power Series, radius of convergence using upper limit, uniform convergence of power series, properties, term by term integration and differentiation, uniqueness of power series.

2. Fourier series. Dirichlet's condition of convergence. Calculation of Fourier's coefficients. Fourier theorem, half range series, sine series, cosine series, Fourier series in arbitrary interval, Parseval's identity, basic theorems.

3. Evaluation of double and triple integrals. Dirichlet's integrals, change of order of integration in double integrals. Differentiability and integrability of an integral of a function of a parameter. Differentiation under the sign of integration

References:

1. Mathematical Analysis-W.Rudin- Tata McGreawHill.
2. Mathematical Analysis-Apostal- Narosa
3. Mathematical Analysis-Malik and Arora-New Age International Pub.

B.A. / B. Sc. Semester-V (Honours)
MATHEMATICS
Paper-VI
Mark : 20+80=100

Unit-I(20)
(Probability)

1.1 Frequency and Axiomatic definition of probability. Random Variable, distribution function, discrete and continuous distribution. Binomial, Poisson, Beta, Gama, Uniform and normal distribution. Poisson process. Transformation of random variables.

1.2 Two dimensional probability distributions, discrete and continuous distribution in two dimensions, Uniform distribution and two dimensional normal distribution. Conditional distribution. Transformation of random variables in two dimensions.

1.3 Mathematical expectation, mean, variance, moment, central moments, measures of dispersion, skewness and curtosis, median, mode, quartiles. Moment generating function, characteristic function, statement of their uniqeness. Two dimensional expectation, covariance, correlation co-eficient, joint characteristic function, multiplication rule for expectation, conditional expectation.

Unit-II(20)
(Statistics)

3.1 Random sample, concept of sampling and various types of sampling, sample and population. Collection, tabulation and graphical representation, grouping of data, sample characteristic and their computation, sampling distribution of statistic.

3.2 Estimates of population characteristic or parameter, point estimation and interval estimation, criterion of a good point estimate, maximum likelihood estimate. Interval estimation of population proportion, interval estimation of a Normal population parameters,

estimate of population parameters with, large sample when distribution of the population is unknown.

3.3 Testing of Hypothesis:null hypothesis and alternative hypothesis. Type one and type two error. testing of hypothesis for a population proportion and Normal population parameters and large sample test for population with unknown distribution. Chi-square test of goodness of fit.

References:

1. Ground Work of Mathematical Probability and Statistics-Amritabha Gupta. Academic Pub.
2. Mathematical Statistics-Gupta and Kapur-Sultan Chand

Unit-III
(Tensor Analysis)

1 Summation Convension. Kronecker symbol. n-dimensional space, transformation of coordinates in S_n. Invariants. covariant and contravariant vectors. Covariant, contravariant and mixed tensors. Algebra of tensors. Symmetric and skew-symmetric tensors. Contraction, outer and inner product of tensors. Quotient law, reciprocal tensor. Riemann space. the line element and metric tensor. raising and lowering of indices, associate tensor. magnitude of a vector, inclination of two vectors, orthogonal vectors. Christoffel symbols and their properties, law of transformation law of Christoffel symbols.

2 Covariant differentiation of tensors, covariant differentiation of sum, difference and product of tensors. Gradient, divergence, curl and Laplacian. Curvilinear coordinate system in E_3 : line element, lengthy of vector, angle between two vectors in E_3 in a curvilinear coordinate system. Basis in a curvilinear coordinate system. reciprocal base, covariant and contravariant components of a vector in E_3, partial derivative of a vector. Sperical and cylindrical coordinate system.

3 Curves in E_3. Parallel vector fields along a curve in E_3, parallel vector field in E_3, parallel vector space in a Riemannian space. parallel vector field in a surface of a Riemannian space. Serret-Frenet formulas.

References:

1. A Text Book of Tensor Calculus-M.C.Chaki: Calcutta Publishers.
2. Tensor Calculus-U.C.De, A.A.Shaikh and J. Sengupta-Narosa.
3. Differentoa Geometry of Curves and Surfaces in E_3(Tensor approach)-U.C.De: Anamaya Publishers

Unit-IV(20)
(Dynamics of Particle)

1 Simple Harmonic Motion. Tangent and normal acceleration. Velocity and acceleration along radial and transverse directions.

3 Central orbits, central forces, motion of a particle under central force. Differential equation in polar and pedal coordinates, velocity under central force. Apse, apsidal distance and apsidal angle.

2.1 Kepler's laws of planetary motion, artificial satellites, Escape velocity, Geo stationary satelite Disturbed orbits.

References:

1. Dynamics of a Particle and of Rigid Bodies-S.L.Lony,Radha Publishing House.
2. Dynamics of Particle and Rigid Bodies-Chakroborty and Ghosh-U.N.Dhur and Sons

B.A. / B. Sc. Semester-VI (Honours)
MATHEMATICS
Paper-VII
Mark : 20+80=100

Unit-I(20)
(Numerical analysis-I)

1 Error in numerical analysis. Gross error, rounding off error, truncation error. Approximate numbers, significant figure. Absolute, relative and percentage error. General formula for error. Δ, ∇, E, δ, μ operators, their properties and interrelations. Equispaced arguments. differece table, propogation of error in difference table.

2 Interpolation: Statement of Weierstrass' approximation theorem, polynomial interpolation and error term in polynomial interpolation, deduction of Lagrange's interpolation formula, inverse interpolation, finding root of a equation by interpolation method. Deduction of Newton's forward and backward interpolation formula. Statement of Gauss's forward and backward interpolation formula. Starling's and Bessel's interpolation formulae. Error terms. Divided difference. Genaral interpolation formulae, deduction of Lagrange's, Newton's forward and backwards interpolation formula.

3 Numerical Differentiation based on Newtons's forward, Newton's backward and Lagrange interpolation formula. Error terms. Numerical integration: Integration of Newton's interpolation formula. Newton-Cotes formula. Deduction of Trapezoidal rule and simpson's 1/3 rule, statement of Weddle's rule. Statements of error terms.
Euler Maclaurin's sum formula.

Unit-II(20)
(Numerical Analysis-II)

2.1 Numerical Solution of non-linear equations: Location of a real roots by tabular method, Bisection method, secant/Regula-Falsi, fixed point iteration and Newton-Raphson method, their geometric significance and convergency, order ofconvergence. Newtons method for multiple roots.

2.2 Numerical solution of a system of linear equations: Gause elimination , Gause-Jordan method. Pivoting strategy in Gauss elimination.LU-Decomposition. Inversion of 3□3 non-singular matrices by Gause elimination and Gause-Jordan method. Gause-Siedel iteration method for system of linear equation.

2.3 Numerical solution of ordinary differential equation of first order: Euler's method, modified euler's method, Picard's method, Taylor's series method, Runge-Kutta method, Milne's method.

Refernces:

1. Numerical Analysis-S.A.Mollah, New Central Book Agency.

Unit-III(20)
(C Programming-I)

Algorithm and flowcharts with simple examples. Bracing and looping.
Introduction to ANSI-C : Character set in ANSI-C. Key words: int, char, float, while etc. Constant and Variables, expressions, assignment statements, formatting source files. Header files.Data types, declarations, different types of integers, different kinds of integer constants, floating-point types, initialization, mixing types, the void data type. Type defs, standard

input/output, finding address of an object. Operations and expressions, precedence and associatively, unary plus and minus operators, binary arithmetic operators, arithmetic assignment operators, increment and decrement operators, comma operator, relational operators, logical operators.

Unit-IV(20)

(C Programming-II)

Control flow, conditional and unconditional bracing, looping, nested loops, if-else, do-while, for, switch, break, continue, goto statements etc., Infinite loops, Functions, Arrays and Pointers

References:

1. Programming in ANSI-C-E.Balaguruswami, Tata McGrawHill.
2. Let Us C-Kanethkar-BPB Pub.

B.A. / B. Sc. Semester-VI (Honours)
MATHEMATICS
Paper-VIII
Mark : 20+80=100
(Practical)

(Numerical Analysis)Mark=40

(Note Book-5+Viva Voce-5+ Numerical Analysis-30=40)

1. Problems on Newton's forward and Backward interpolation. Lagrange interpolation formula. Inverse interpolation. Finding root of a equation by interpolation method.
2. Differentiation formula based on Newton's forward and backward interpolation formula.
3. Numerical integration by Trapezoidal, Simpson's 1/3 rule and Weddle's rule.
4. Finding roots of an equation by Bisection method, Regula Falsi method, fixed point iteration method, Newton-Raphson method.
5. Solution of linear equation by Gauss elimination method, Gauss-Jordan method and Gauss-Siedel method.
6. Finding inverse of a third order matrix without finding its determinant.
7. Runge-Kutta Method

(C-Programming)Mark=40

(Note Book-5+Viva Voce-5+C-Programming-30=40)

1. Ascending / Descending order. Finding Largest / smallest.
2. Sum of finite series.
3. Sum of Convergent series.
4. Bisection method.
5. Checking whether a number is prime or not. Generation of prime numbers.
6. Solution of Quadratic equation
7. Newton's forward and Backward interpolation. Lagrange interpolation.
8. Bisection method. Newton-Raphson method. Regula Falsi method.
9. Trapezoidal Rule. Simpson's 1/3 rule.
10. Value of Determinant.
11. Matrix sum, subtraction, product, transposition.
12. Cramer's Rule (upto three variables).
13. Solution of linear equation by Gause elimination method, Gause-Jordan method.
14. Runge-Kutta Method.
15. Mean, variance, correlation coefficient, equation of regression lines.