DEPARTMENT OF MATHEMATICS

Course Structure & Syllabi for MINOR Programme in Mathematics (To be applicable for BTech 2010-batch onwards)

Semester	Course Code	Course Title	L-T-P-C
3rd	MA 211M	Real Analysis	3 - 0 - 0 - 6
4th	MA 212M	Mathematical Statistics	3 - 0 - 0 - 6
5th	MA 311M	Scientific Computing	3 - 0 - 2 - 8
6th	MA 312M	Modern Algebra	3 - 0 - 0 - 6
7th	MA 411M	Differential Geometry	3 - 0 - 0 - 6
		Total credits	**15- 0- 2-32**

MA 211M Real Analysis (3-0-0-6)

Metrics and norms – metric spaces, normed vector spaces, convergence in metric spaces, completeness, pointwise and uniform convergence of sequence of functions; Functions of several variables – differentiability, chain rule, Taylor's theorem, inverse function theorem, implicit function theorem; Introduction to Lebesgue measure and integral – measureable sets, measurable functions, Lebesgue integral, dominated convergence theorem, monotone convergence theorem.

Texts:

1. N. L. Carothers, *Real Analysis*, Cambridge University Press, 2000.
2. J. E. Marsden and M. J. Hoffman, *Elementary Classical Analysis*, 2nd Ed., W. H. Freeman, 1993.

Reference:

1. M. Capinski and E. Kopp, *Measure, Integral and Probability*, 2nd Ed., Springer, 2007.

MA 212M Mathematical Statistics (3-0-0-6)

Probability – probability spaces, random variables and random vectors, functions of random vectors, univariate and multivariate distributions, mathematical expectations, moment generating functions, convergence in probability and in distribution and related results; Sampling distributions; Point estimation – estimators, sufficiency, completeness, minimum variance unbiased estimation, maximum likelihood estimation, method of moments, Cramer-Rao inequality, consistency; Interval estimation; Testing of hypotheses – tests and critical regions, Neymann-Pearson lemma, uniformly most powerful tests, likelihood ratio tests; Correlation and linear regression.

Texts:

1. R. V. Hogg, J. W. McKean and A. Craig, *Introduction to Mathematical Statistics,* 6th Ed., Pearson Education India, 2006.
2. B. L. S. Prakasa Rao, *A First Course in Probability and Statistics*, World Scientific/Cambridge University Press India, 2009.

References:

1. V. K. Rohatgi and A. K. Md. E. Saleh, *An Introduction to Probability and Statistics*, 2nd Ed., Wiley India, 2000.
2. G. Casella and R. L. Berger, *Statistical Inference*, 2nd Ed., Duxbury Press/Thompson Learning India, 2002.

MA 311M Scientific Computing (3-0-2-8)

Errors; Iterative methods for nonlinear equations; Polynomial interpolation, spline interpolations; Numerical integration based on interpolation, quadrature methods, Gaussian quadrature; Initial value problems for ordinary differential equations – Euler method, Runge-Kutta methods, multi-step methods, predictor-corrector method, stability and convergence analysis; Finite difference schemes for partial differential equations – Explicit and implicit schemes; Consistency, stability and convergence; Stability analysis (matrix method and von Neumann method), Lax equivalence theorem; Finite difference schemes for initial and boundary value problems (FTCS, Backward Euler and Crank-Nicolson schemes, ADI methods, Lax Wendroff method, upwind scheme).

Texts:

1. D. Kincaid and W. Cheney, *Numerical Analysis: Mathematics of Scientific Computing*, 3rd Ed., AMS, 2002.
2. G. D. Smith, *Numerical Solutions of Partial Differential Equations*, 3rd Ed., Calrendorn Press, 1985.

References:

1. K. E. Atkinson, *An Introduction to Numerical Analysis*, Wiley, 1989.
2. S. D. Conte and C. de Boor, *Elementary Numerical Analysis - An Algorithmic Approach*, McGraw-Hill, 1981.
3. R. Mitchell and S. D. F. Griffiths, *The Finite Difference Methods in Partial Differential Equations*, Wiley, 1980.

MA 312M Modern Algebra (3-0-0-6)

Formal properties of integers, equivalence relations, congruences, rings, homomorphisms, ideals, integral domains, fields; Groups, homomorphisms, subgroups, cosets, Lagrange's theorem , normal subgroups, quotient groups, permutation groups; Groups actions, orbits, stabilizers, Cayley's theorem, conjugacy, class equation, Sylow's theorems and applications; Principal ideal domains, Euclidean domains, unique factorization domains, polynomial rings; Characteristic of a field, field extensions, algebraic extensions, finite fields.

Texts:

1. N. H. McCoy and G. J. Janusz, *Introduction to Abstract Algebra*, 6th Ed., Elsevier, 2005.
2. J. A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1998.

References:

1. I. N. Herstein, *Topics in Algebra*, Wiley, 2004.
2. J. B. Fraleigh, *A First Course in Abstract Algebra*, Addison Wesley, 2002.

MA 411M Differential Geometry (3-0-0-6)

Local theory of plane and space curves, curvature and torsion formulas, Serret-Frenet formulas, fundamental Theorem of space curves; Regular surfaces, change of parameters, differentiable functions, tangent plane, differential of a map; First and second fundamental form; Orientation, Gauss map and its properties, Euler's theorem on principal curvatures; Isometries, Gauss' Theorema Egregium; Parallel transport, geodesics, Gauss-Bonnet theorem and its applications to surfaces of constant curvature.

Texts:

1. J. McCleary, *Geometry from a Differentiable Viewpoint*, Cambridge University Press, 1994.
2. A. Pressley, *Elementary Differential Geometry*, Springer, 2002.

Reference:

1. M. P. Do Carmo, *Differential Geometry of Curves and Surfaces*, Prentice Hall, 1976.