INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Name of the Department : **MATHEMATICS DEPARTMENT**

1. Subject Code: 501C Course Title: **PROBABILITY AND STATISTICS**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs): Theory **03** Practical **0**
4. Relative Weight: CWS: **25** PRS: **0** MTE: **25** ETE: **50** PRE: **0**
5. Credits: **04** 6. Semester: **Autumn**
7. Subject Area: **ICC** 8. Pre-requisite: **Nil**
9. Objective: To impart to the students in depth knowledge of probability and statistics.
10. Details of Course

S. No.	Contents	Contact Hours
1	Review of concepts of probability, random variable and distribution functions ; Discrete and continuous moments and moment generating functions	5
2	Binomial, Poisson, Negative binomial, geometric, hypergeometric distributions ; Uniform, exponential, gamma, beta, Weibull, normal, logonormal, and Pearson distributions	6
3	Law of large numbers, central limit theorem	2
4	Bivariate random variables, statistical independence, joint distribution, marginal, conditional product moment; Correlation function of random variables	4
5	Simple random sampling-with replacement and without replacement; Sampling distributions on samples from normal population: normal t, x^2 and F distributions	3
6	Estimation parameters; Point estimation, estimation methods, method of moment; Maximum Likelihood interval estimation	4
7	Testing of hypothesis: simple vs simple hypothesis with MP lemma, Composite vs composite hypothesis ML ratio tests, Tests based on normal population: one sample and two samples tests	6
8	ANOVA: one way classification, two way classification	4
9	Linear regression analysis: Simple regression- Estimation of coefficient, confidence interval for coefficients hypothesis, tests for coefficients	5
10	Multiple regression, Polynomial regression	3
	TOTAL	**42**

11. Suggested Books

S. No.	Name of Authors/Books/Publisher	Year of Publication/ Reprint
1	R. V. Hogg and A. Craig : Introduction to Mathematical Statistics, 5th edition, Pearson Education	2006
2	R. V. Hogg and A. Craig , Probability and Statistical Inference , 6th edition, Pearson Education	2006
3	W. W. Hines, D.C. Montgomery, D. M. Goldsman and C. M. Borror, Probability and Statistics in Engineering, John Wiley and sons	2003
4	C. R. Rao, Linear Statistical Inference and its application, Wiley Eastern Ltd.	2002
5	E.L. Lehman, Testing of Statistical Hypothesis, Wiley Eastern Ltd.	2005
6	E.L. Lehman, Point Estimation, 2nd Edition, Wiley & Sons	1998

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Name of the Department: **MATHEMATICS DEPARTMENT**

1. Subject Code: 501E Course Title: **OPTIMIZATION TECHNIQUES**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs): Theory **03** Practical **0**
4. Relative Weight: CWS: **25** PRS: **0** MTE: **25** ETE: **50** PRE: **0**
5. Credits: **04** 6. Semester: **Autumn**
7. Subject Area: **ICC** 8. Pre-requisite: **Nil**
9. Objective: To impart to the students in depth knowledge of optimization techniques
10. Details of Course

S. No.	Contents	Contact Hours
1	**OR Models** : Different types of OR Models and their constructions	4
2	**Linear Programming**: Convex sets, graphical method, simplex method, revised simplex method; Duality theory, dual simplex method; Sensitivity analysis, multi objective and goal programming; Solutions using graphical and simplex methods	8
3	**Integer Linear Programming**: Cutting plane, branch and bound techniques for all integer and mixed integer programming.	6
4	**Nonlinear Programming**: Convex functions, Kuhn Tucker conditions, Convex quadratic programming, Wolfe's and pivot complementary algorithms	7
5	**Dynamic Programming**: Discrete and Continuous dynamic programming, Simple illustrations.	7
6	**Search Techniques**: Direct search and gradient methods; Unimodal functions, Fibonacci search, golden section method, Steepest descent method, Newton-Raphson Method, Hookes and Jeeves method; Conjugate gradient method	10
	TOTAL	**42**

11. Suggested Books

S. No.	Name of Authors/Books/Publisher	Year of Publication /Reprint
1	Taha, H.A., Operations Research- An Introduction, Prentice Hall (7^{th} Edition)	2002
2	Ravindran, A., Phillips, D.T. and Solberg, J.J., Operations Research: Principles and Practice, 2^{nd} Edition, John Wiley and Sons,	2009
3	Hiller, F.S. and Liebermann, G.J., Introduction to Operations Research, Tata McGraw Hill,	2002
4	Mittal, K.V. and Mohan, C., Optimization Methods in Operations Research and Systems Analysis, New Age	2003
5	Chandra, Suresh, Jayadeva and Mehra, Aparna, Numerical Optimization with Applications,	2009
6	Mohan, C. and Deep, Kusum: Optimization Techniques, New Age	2009

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Name of the Department: **MATHEMATICS DEPARTMENT**

1. Subject Code: MA-501F Course Title: **Numerical Analysis, Probability and Statistics**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWS: **25** PRS: **0** MTE: **25** ETE: **50** PRE: **0**
5. Credits: **04** 6. Semester: **Autumn**
7. Subject Area: **ICC** 8. Pre-requisite: **Nil**
9. Objective: To impart to the students in depth knowledge of probability and statistics.
10. Details of Course

S. No.	Contents	Contact Hours
1	LU-decomposition, Crouts method, Jacobi's and Gauss-Seidel iterative methods for solving linear equations; Newton-Raphson and fixed point iteration methods to find roots of non-linear equation(s) in one and two variables.	6
2	Review of various interpolation formulae, Numerical differentiation using Newton's forward, backward and Stirling's formulae and divided difference formula; Review of Trapezoidal, Simpson's and Gauss-Legendre Quadrature formulae for numerical integration	5
3	Euler, Modified Euler and 4^{th} order Runge Kutta methods for solving initial value problems; Finite difference methods for two point boundary value problems.	4
4	Numerical Solution of parabolic and elliptic partial differential equations; Finite difference methods and methods of weighted residuals such as collocation, least square and Galerkin's methods.	6
5	Review of concept of Probability; Random variable, discrete and continuous probability distribution functions, moments and moment generating functions	4
6	Binomial, Poisson, negative binomial, geometric and hyper geometric distributions; Uniform, exponential, gamma, beta, Weibull, Normal, Lognormal and Pearsons distributions; Sampling and sampling distributions	6
7	Bivariate distributions, statistical independence; Correlation and regression	3
8	Point and interval estimation, testing of hypothesis	5
9	Analysis of variance and concept of design of experiments	3
10	**TOTAL**	**42**

11. Suggested Books

S. No.	Name of Authors/Books/Publisher	Year of Publication/ Reprint
1	R. V. Hogg and A. Craig, Introduction to Mathematical Statistics, 5th edition, Pearson Education	2006
2	R. V. Hogg and A. Craig , Probability and Statistical Inference , 6th edition, Pearson Education	2006
3	C. R. Rao, Linear Statistical Inference and its application, 2nd Edition, Wiley Easter Ltd.	2002
4	E.L. Lehman, and Joseph P. Ramano: Testing of Statistical Hypothesis, 3rd Edition, Sringer.	2005
5	Gerald C.F. and Whitely O.P., Applied Numerical Analysis, Addison-Wesely	1970
6	Jain M.K., Numerical Solution of Differential; Equations, Wiley Easter Ltd..,	2005
7	Jain M. K. , Iyenger, S.R.K. and Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International Pvt. Ltd.	2001
8	Conte S.D. and Carl de Boor, Elementary Numerical Analysis, McGraw-Hill	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Name of the Department: **MATHEMATICS DEPARTMENT**

1. Subject Code: MA- 561 Course Title: **Discrete Mathematics**
2. Contact Hours: **L: 3 T: 1 P: 0**
3. Examination Duration (Hrs): Theory **03** Practical **0**
4. Relative Weight: CWS: **25** PRS: **0** MTE: **25** ETE: **50** PRE: **0**
5. Credits: **04** 6. Semester: **Autumn**
7. Subject Area: **ICC** 8. Pre-requisite: **Nil**
9. Objective: To impart to the students in depth knowledge of probability and statistics.
10. Details of Course

Logic and Connectives, Truth Tables, Arguments and Proofs, Relations-Digraphs, Adjacency Matrix, Equivalence Relations, Order Relations, Paths, Closures, Function, Recursion-Relations and Solution, Inductive Process, Generating Functions, Discrete Functions. Boolean Algebra: Lattices, Sublattices, Isomorphism, Boolean Algebra, and Application of Circuit Theory, Circuit Minimization, Automata: Monoids, Isomorphism, Grammars and Their Types, Languages, Finite State Machines, Monoid and Machine.