



REVISED CODE

EXISTING CODE		NAME OF THE PAPER	REVISED CODE
1	M101	MATHEMATICS	M101
2	M201	MATHEMATICS	M201
3	M301	MATHEMATICS	M301
4	M302	MATHEMATICS	M302
5	M303	MATHEMATICS (MECHANICAL & PRODUCTION)	M303
6	M315	MATHEMATICS – III	M315
7	M401	MATHEMATICS	M401
8	MM101	DISCRETE MATHEMATICAL STRUCTURE	M(MCA)101
9	MM301	STATISTICS & NUMERICAL TECHNIQUES	M(MCA)301
10	MM391	STATISTICS & NUMERICAL ANALYSIS LAB (PRACTICAL)	M(MCA)391
11	CS312	NUMERICAL METHODS & PROGRAMMING	M(CS)312
12	CS382	NUMERICAL METHODS & PROGRAMMING LAB (PRACTICAL)	M(CS)382
13	CS402	OPERATION RESEARCH & OPTIMIZATION TECHNIQUES	M(CS)402
14	CS511	OPERATION RESEARCH & OPTIMIZATION TECHNIQUES	M(CS)511
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16	CE301	CIVIL ENGINEERING-III SEMESTER MATHEMATICS	M(CE)301
17	MB105	QUANTITATIVE METHODS-1	M(MBA)105
18	MB203	QUANTITATIVE METHODS	M(MBA)203
19	MB205	OPERATIONS RESEARCH	M(MBA)205
20	M(CT)301	APPLIED MATHEMATICS	M(CT)301
21	CS(CT)401	COMPUTER SCIENCE & OPERATION RESEARCH	M[CS(CT)]401



MATHEMATICS

Code : M101
 Contacts : 3L+ IT=4
 Credits : 4

Infinite series :

Sequence, convergence & divergence of infinite series – and typical examples of convergent and divergent series. 1L

Comparison test (statement only) and related problems 1L

Ratio test (statement only) & related problems 1L

Cauchy's root test (statement only) & related problems 1L

Alternating series Leibnitz's theorem (without proof), absolute convergence & related problems 2L

Calculus of functions of one variable :

Review of limit & continuity and differentiability 1L

Successive differentiation, Leibnitz's theorem [without proof but with problems of the type of recurrence relations in derivatives of different orders & also to find $(y_n)''$] : 3L

Rolle's theorem (statement only) ; Mean value theorems-Lagrange & Cauchy (statement only), Taylor's theorem (without proof and problems in respect of direct use and applications of the theorem only), expansions of functions by Taylor & Maclaurin series. Maclaurin's series expansion in infinite series of the functions $\log(1+x)$, e^x , $\sin x$, $\cos x$, $(a+x)^n$, n being a negative integer or a fraction L' Hospital's Rule (statement only) and related problems. 6L

Integration of 2L

$$\int_0^{\pi/2} \cos^n \chi \, d\chi, \int_0^{\pi/2} \sin^n \chi \, d\chi, \int_0^{\pi/2} \cos^n \chi \sin^m \chi \, d\chi, \int_0^{\pi/2} \cos m\chi \sin n\chi \, d\chi, \text{ m, n are positive integers}$$

Application :

Rectification 1L

Three Dimensional Geometry (Cartesian) :



Direction cosine, direction ratio ; Equation of a plane (general form, normal form & 4L intercept form) ; Equation of a straight line passing through one point & two points ;
Pair of intersecting planes representing a straight line .

Elementary ideas of surfaces like sphere, right circular cone and right circular cylinder (through geometrical configuration) and equation in standard forms.

Calculus of functions of several variables :

Introduction of function of several variables & examples 2L
Knowledge of limit & continuity

Partial derivative & related problems Homogeneous functions & Euler's theorem (statement only) & problems upto 3 variables. 3L

Chain rules and related problems.
Differentiation of implicit functions & related problems. 4L
Total differentials & related problems

Maxima, minima and saddle points – definition , condition of extrema and problems for two variables. Lagrange's multiplier method – problems related to two variables only . 2L

Line integral, double integral, triple integral – discussion w.r.t. different types of limits & problems ; moment of inertia , centre of gravity . 3L

Jacobian – definition & related problems for two variables . 2L
Application to areas & volumes, surface area of revolution .

Vector Calculus:

Scalar and vector fields – definition and terminologies ; products : dot, cross, box, vector triple product . 2L

Gradient , directional derivative, divergence, curl (with problems). 2L

Tangent planes and normals and related problems. 1L

Statements of
Green's theorem, divergence theorem, Stokes' theorem with applications. 4L

Total 48L



Text Books :

1. **G.B. Thomas and R.L. Finney “ Calculus and Analytic Geometry” , 6th Edition , Addison Wesley / Narosa, 1985.**
2. **Piskunov , “Differential and Integral Calculus ” Vol –I & II, Mir Publishers, Moscow, 1979.**
3. **B.S. Grewal “Engineering Mathematics”, S. Chand & Co., New Delhi.**
4. **Integral Calculus , Das & Mukherjee**
5. **An Introduction to Real Analysis – S.K. Mapa**
6. **Higher Algebra – Lahiri & Roy**
7. **Higher Algebra, Ghosh & Chakraborty**
8. **Higher Algebra , Bernard & Child**
9. **Deferential Calculus, Maity & Ghosh**
10. **Integral Calculus, Maity & Ghosh**
11. **Engineering Mathematics, Prof. T. Mazumder**
12. **An Introduction to Analysis, Mallick & Arora**
13. **Undergraduate Engg. Math . – Jana , Vikas**
14. **Engineering Math Vol. 1,2,3 – Lakshami, Vikas**
15. **Calculus Of One Variables – Pandey G.S. (New Age International)**
16. **Differential Calculus – Dhami H.S (New Age International)**
17. **Integral Calculus - Dhami H.S (New Age International)**
18. **Numerical Methods for Engineers – Gupta S.K. (New Age International)**
19. **A Text Book of Engg. Maths Vol 1 & Vol. 2 – Dutta. D (New Age International)**
20. **Advanced Engg. Mathematics By D.P. Das, Cyber Tech**



MATHEMATICS

Code : M201

Contacts : 3L+ LT=4

Credits : 4

Linear Algebra :

Introduction to the idea of a matrix; equality of matrices ; special matrices. 2L

Algebraic operation of matrices : commutative property, associative property & distributive property, transpose of a matrix [properties $(A^t)^t = A$, $(A+B)^t = A^t + B^t$, $(cA)^t = cA^t$, $(AB)^t = B^t A^t$ to be stated (without proof) and verified by simple examples] symmetric and Skew symmetric matrices.

Properties of determinant (Statement only); minor, co-factors Laplace expansion of determinant; Cramer's rule and its application in solving system of linear equations of three variables. 2L

Singular and non –singular matrices ; adjoint matrix ; inverse of a matrix [$(AB)^{-1} = B^{-1} A^{-1}$ to be stated and verified by example. Elementary row and column operations on matrices ; definition of rank of a matrix ; determination of rank of a matrix using definition . 2L

System of Linear Equations

Consistency and Inconsistency . Gauss elimination process for solving a system of linear equations in three unknowns. 2L.

Vector space:

Basic idea of set , mapping , Binary Composition and Scalar field . Definition of vector space over the field of real numbers ; Examples of vector space; definition of sub–space of a vector space and a criterion for a sub-space ; Definition of linear combination, Linear independence and linear dependence of vectors with examples. Definition of basis and dimension of vector space ; Definition of Linear transformation; Definition of kernel and images of a linear transformation ; Kernel and images of Linear transformation forming sub-spaces ; Nullity and Rank of a Linear Transformation ; $\text{Dim Ker } T + \text{Dim Im } T = \text{Dim } V$; Definition of Inner product space ; Norm of a vector ; Orthogonal and Ortho-normal set of vectors. 7L

Eigenvalues and Eigenvectors of a matrix ; Eigenvalues of a Real Symmetric Matix; Necessary and Sufficient Condition of diagonalization of matrices (statement only); Diagonalization of a matrix (problems restricted to 2×2 matrix) 2L



Definition of order and degree of ODE; 4L

ODE of the first order : exact equations ; definition and use of integrating factor ; Linear Equation and Bernoulli's equation. ODE of the first order and higher degree , simple problems.

General ODE of second order : D-operator method for finding particular integrals . 6L
Method of variation of parameters. Solution of Cauchy–Euler homogeneous linear equations. Solution of simple simultaneous linear differential equation.

Verification of Legendre function [$P_n (X)$] and Bessel function [$J_n (X)$] as the 2L
solutions of the Legendre and Bessel equations respectively. Graphical representation of these solutions.

Laplace transform (LT):

Definition ; existence of LT; LT of elementary functions; First and second shifting 6L
Properties ; Change of scale property; LT of derivative of functions. LT of $(t^n f(t))$ LT of $f(t) / t^n$; LT of periodic function and unit step function . Convolution theorem (statement only).

Inverse LT ; solution of ODE 's (with constant coefficients) using LT. 4L

Numerical Methods :

Error : Absolute, Percentage, Relative errors . Truncation error, round - off error . 5L
Difference operator (forward, backward, central, shift and average operators); Different table , Propagation of Error .Definition of interpolation and extrapolation. Newton's forward and backward interpolation formula; Lagrange interpolation formula and corresponding error formulae (statement only).

Numerical Differentiation: Using Newton's forward and backward interpolation formula 4L

Numerical integration : Trapezoidal rule and Simpson's 1/3rd rule and corresponding error terms (statement only)

Total 48L



Kreyzig E. Krishnamurthy V, Mainra V.P. and Arora J.L	Advanced Engineering Mathematics An Introduction to Linear Algebra
Boyce and Diprima	Elementary Differential Equations and Boundary Value Problems
Grewal B.S.	Engineering Mathematics
S.K.Rathor	Higher Engineering Mathematics II.EPH
Lakshminarayan	Engg. Math. , Vikas
Jana	UG Engg. Mathematics, Vikas
Chakraborty A.	Elements of Ord. Diff. Equations, New Age
Bhattacharya P.B	First Course in Linear Algebra, New Age
Rao Sarveswar A.	Engg. Mathematics, University Press
Gupta S.K.	Numerical Methods for Engineers, New Age
Jain M.K.	Numerical Methods for Sc. & Engg. Computation, New Age International
Jain M.K	Numerical Solution of Differential Equations
Balachandra Rao	Numerical Methods with Programmes in Basic, Fortran, Pascal, and C++
Dutta N.	Computer Programming and Numerical Analysis: An Integral Approach, Universities Press
Rao S.B.	Differential Equations with Applications & Programs, University Press
Murray D.A.	Introductory Course in Differential Equations
Bagchi S.C.	First Course on Representation Theory & Linear Lie Groups , Universities Press
Arumugam	Engineering Mathematics I, II & III, Scitech



MATHEMATICS

Code : M301

Contacts : 3L+ LT

Credits : 4

Probability

Random Experiment; Sample space; Random events; Probability of events . 10L

Axiomatic definition of probability; Frequency definition of probability; Finite sample spaces and equiprobable measure as special cases ; Probability of non-disjoint events (Theorems). Counting techniques Applied to probability problems; Conditional probability; General Multiplication theorem ; Independent events; Bayes' theorem and related problems

Random variables (discrete and continuous) ; Probability mass function ; 10L

Probability density function and distribution function. Distributions : Binomial, Poisson , Uniform, Exponential, Normal, t & χ^2 . Expectation & Variance (t & χ^2 excluded); Moment generating function ; Reproductive Property of binomial; Poisson and Normal Distribution (Proof not required). Transformation of random variables (one variable); Chebychev inequality (statement) and problems.

Binomial approximation to Poisson distribution and Binomial approximation 6L

to Normal distribution (statement only); Central Limit Theorem (statement) Law of large numbers (Weak law); Simple applications.

Statistics :

Population: Sample ; Statistic; Estimation of parameters (Consistent and 18L

Unbiased) ; Sampling distribution of sample mean and sample variance (proof not required).

Point estimate ; Maximum likelihood estimate of statistical parameters (Binomial, Poisson and Norma distribution). Interval estimation .

Testing of Hypothesis :

Simple & composite hypothesis ; Critical region; Level of Significance ; Type 4L

I and Type II Errors ; Best Critical Region ; Neyman–Parson Theorem (Proof not required) ; Application to Normal Population ; Likelihood Ratio Test (Proof not required) ; Comparison of Binomial Populations ; Normal Populations ;

Testing of Equality of Means ; χ^2 -test of Goodness of Fit (application only).

Simple idea of Bivariate distribution ; Correlation and Regression ; and Simple problems .

Total 48 L



MATHEMATICS

Code : M302

Contacts : 3L+ LT

Credits : 4

Fourier Series :

Introduction: Euler's formula; Problems on general Fourier Series; Conditions for Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even and Odd functions; Change of interval; Half range series; Typical waveforms (Square, Saw-toothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity (statement only); Fourier Transform (FT) and its properties; Inverse Fourier Transform (statement only); Fourier transform of Derivative (statement only); Convolution (statement only); Application of Fourier Transform in solving partial differential equations –Laplace's Equation (2D only), Heat Conduction Equation (1D only) and Wave Equation (1D only). 12L

Calculus of Complex Variable:

Functions; Limits and Continuity; Analytic Functions; Cauchy-Riemann Conditions; Analytic Continuation; Complex Integration and Cauchy's Theorem; Cauchy's Integral Formula; Taylor's and Laurent Series; Zeros of an Analytic Function; Poles; Essential Singularities; Residue Theorem (statement only) and its application to evaluation of integral; Introduction to Conformal Mapping; Simple problems. 14L

Probability and Statistics:

Mean, Median, Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability Distributions-Probability mass function; Probability Density Function; Distribution Function; Expectation; Variance; Probability Distribution – Binomial, Poisson and Normal. Correlation and Regression; Method of Least Squares; Linear Curve Fitting. 10L

Graph Theory:

Graphs; Digraphs; Isomorphism; Walk; Path; Circuit; Shortest Path :Dijkstra's Algorithm; Tree; Properties of Tree; Binary Tree; Fundamental Circuit; Minimal Spanning Tree: Kruskal's Algorithm; Prim's Algorithm. Cut set; Fundamental Cut Set and Cut Vertices; Matrix Representation of Graphs (Adjacency and Incidence Matrices); Network; Flow Augmenting Path; Ford-fulkerson Algorithm for Maximum Flow; Max Flow – Min Cut Theorem (statement only). 12L

Total 48L

Text Books:

1. Rathor, Choudhari : Discrete Structure and Graph Theory.
2. Gupta S.C. and Kapoor V.K. : Fundamentals of Mathematical Statistics – Sultan Chand & Sons.
3. Lipschutz S; Theory & Problems of Probability (Schaum's Outline Series)- McGraw Hill Book Co.
4. Spiegel M.R : Theory & Problems of Probability and Statistics (Schaum's Outline Series)- McGraw Hill Book Co.



5. Goon A.M., Gupta M.K. and Dasgupta B: Fundamental of Statistics – The World Press Pvt. Ltd.
6. Spiegel M.R. : Theory and Problems of Complex Variables (Schaum’s Outline Series) McGraw Hill Book Co.
7. Bronson R : Differential Equations (Schaum’s Outline Series) McGraw Hill Book Co.
8. Ross S.L. : Differential Equations – John Willey & Sons

9. Sneddon I.N. : Elements of Partial Differential Equations - (McGraw Hill Book Co.)
10. West D.B. : Introduction to Graph Theory – Prentice Hall

11. Deo N : Graph Theory with Applications to Engg. and Computer Science – Prentice Hall
12. Grewal B. S. : Higher Engineering Mathematics (Thirtyfifth edn) Khanna Pub.
13. Kreyzig E: Advanced Engineering Mathematics – John Willey & Sons.
14. Jana – Undergraduate Mathematics
15. Lakshminarayan – Engineering Math 1.2.3
16. Gupta – Mathematical Physics (Vikas)
17. Singh – Modern Algebra
18. Rao B. : Differential Equations with Applications & Programmes, Universities Press
19. Murray : Introductory Courses in Differential Equations, Universities Press
20. Delampady , M : Probability & Statistics, Universities Press
21. Prasad : Partial Differential Equations, New Age International .
22. Chowdhury : Elements of Complex Analysis, New Age International
23. Bhat : Modern Probability Theory, New Age International
24. Dutta : A Text Book of Engg. Mathematics Vol. 1 & 2 , New Age International
25. Sarveswa, Rao : Engineering Mathematics Universities Press
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26. Dhami : Differential Calculus, New Age International



MATHEMATICS (MECHANICAL & PRODUCTION)

Code : M303

Contacts : 3L+ LT

Credit : 4

Alotted Hrs. : 48L

Series Solution of Ordinary Differential Equation (ODE); Special Functions :

Introduction, validity of series solution of an ordinary differential equation, 12L
general method to solve equation of the type: $P_0 y'' + P_1 y' + P_2 y = 0$; Problems ;
Bessel's equation ; Properties of Bessel's function ; Recurrence formula for Bessel's
Function of first kind $[J_n(x)]$; Equation reducible to Bessel's equation ; Legendre's
equation ; Legendre function; Recurrence formula for Legendre function $[P_n(x)]$;
Orthogonality relation.

Calculus of Complex Variable :

Functions, Limits and Continuity , Analytic Functions, Cauchy-Riemann Conditions, 10L Analytic Continuation,
Complex Integration and Cauchy's Theorem, Cauchy's
Integral Formula, Taylor's and Laurent Series , Zeros of an Analytic Function ;
Poles, Essential Singularities, Residue Theorem and its application to evaluation
of integral , Introduction to conformal Mapping Simple problems.

Partial Differential Equations (PDE) and its Applications :

Introduction, Linear and nonlinear equations of first order ; examples; 14L
Homogeneous linear equations with constant coefficients and variable coefficient
of second order, Separation of variables, Formulation and solution of wave equation ;
One dimensional heat flow equation and solution ; Two dimensional heat flow
equation and solution.

Linear Programming Problem (L.P.P) :

Mathematical Formulation, Graphical Solution and Simplex Method, Charnes 12L
Big – M Method, Transportation Problems, Assignment Problems (Hungarian Method).

Total 48L

Reference :

1. Higher Engineering Mathematics by Dr.B.S. Grewal
2. Linear Programming & Game Theory by Chakraborty & Ghosh
3. Complex Variables by M.R.Spiegel
4. Partial Differential Equation by K.S. Rao
5. Engineering Mathematics, Arumugam, Scitech



MATHEMATICS –III (CHEMICAL & BIO-TECHNOLOGY)

Code : M315

Contacts : 3L+ LT

Credit : 4

Alotted Hrs. : 48L

Fourier Series :

Introduction ; Euler's formula ; Problems related to Fourier series ; Conditions for Fourier expansion ; Functions having points of discontinuity ; Change of Interval ; Even and Odd functions ; Half Range series ; Typical Waveforms (square,saw-toothed,triangular, half wave rectifier , full wave rectifier) 12L

Series Solution of Ordinary Differential Equation (ODE) ; Special Functions :

Introduction, validity of series solution of an ordinary differential equation, 14L
General method to solve equation of the type $P_0 y'' + P_1 y' + P_2 y = 0$; Problems ;
Bessel's equation ; Properties Bessel's function ; Recurrence formula for Bessel's
Function of first kind [$J_n(x)$] ; Equation reducible to Bessel's equation ; Legendre's
equation ; Legendre function; Recurrence formula for Legendre function [$P_n(x)$] ;
Orthogonality relation.

Partial Differential Equations (PDE) and its Applications :

Introduction, linear and nonlinear PDE of first order ; examples; 14L
homogeneous linear PDE of 2nd order with constant coefficients and variable coefficients ;
Separation of variables, Formulation and solution of wave equation (1D) ;
One dimensional heat flow equation and solution ; Two dimensional heat flow
equation and solution.

Statistics :

Mean ; Median ; Mode ; Standard Deviation ; Variance ; Random Variable ; 10L
Discrete and Continuous Probability Distribution : Distributions and Density Function;
Mathematical Expectation ; Standard Probability Distributions: Binomial, Poisson
and Normal; Correlation and Regression ; Linear Curve Fitting – Least Square Method.

Total 48L

Text Books / References :

1. Advanced Engineering Mathematics : E. Kreyzig, Wiley, 5th Edn.
2. Higher Engineering Mathematics : B.S. Grewal , 1997
3. Engineering Mathematics Vol. 1& 2, Shastri PHI
4. Fundamental Concepts of Mathematical Statistics : Gupta and Kapoor , S. Chand .
5. Advanced Engineering Mathematics, Greenberg, Pearson Education
6. Statistical Methods : N.G.Das
7. Elements of Partial Differential Equation : Sneddon , MGH



MATHEMATICS

Code : M401

Contacts : 3L+ LT

Credit : 4

Algebraic Structure

Sets, Relation, Equivalence Relation, Equivalence Class & Partition ; 16L
Congruence Relation. Mapping; Inverse Mapping (Proof of Necessary and Sufficient Condition Excluded) . Semigroup and Monoid; Group ; Subgroup and Coset ; Normal Subgroup ; Quotient Group ; Cycle Group, Permutation Group; Dihedral Group (upto D_4); Symmetric Group S_3 , Homomorphism and Isomorphism ; Modulo Group ; Elementary Applications in Coding.

Ring and Field : Ring ; Subring ; Morphism of Ring ; Ideals and Quotient Ring. 6L
Integral Domain and Field ; Finite Field ; Statement of Relevant Theorems and Examples.

Lattice and Recurrence Relation :

Basic Idea ; Sequence and Discrete function. Generating functions and application. 4L

Graph and Algorithm :

Graph ; Digraph ; Isomorphism ; Walk; Path ; Circuit ; Shortest Path Problems : 16 L
Dijkstra's Algorithm ; Tree ; Properties of Tree ; Binary Tree and Fundamental Circuit ; Minimal Spanning Tree : Kruskal's Algorithm ; Prim's Algorithm ; DFS ; BFS. Cut Set : Fundamental Cut Set and Cut Vertices. Planar and Dual Graphs ; Matrix Representation of Graphs (Adjacency and Incidence Matrices) ; Network ; Flow Augmenting Path ; Ford-Fulkerson Algorithm for Maximum Flow ; Floyd Algorithm ; Max-Flow and Min-Cut Theorem (Statement only)

Total 48L

Text :

1. Liu C.L., "Introduction to Combinatorial Mathematics", McGraw Hill, 1968.
2. Mott J.L., Kandel A. and Baker T.P., " Discrete Mathematics for Computer Scientists and Mathematician ", PH, 1986.
3. Rosen – Discrete Mathematics, 2/e, TMH
4. S.K Mapa – Higher Algebra (Abstract & Modern)
5. Robert J. McElice , Robert B.Ash & Carol Ash, "Introduction to Discrete Mathematics" , Tata McGraw Hill
6. Deo N., "Graph Theory with Applications to Engineering and Computer Science", PHI, 1980 .



7. Tremblay and Manohar, “ Discrete Mathematical Structures with Applications to Computer Science ” , McGraw Hill, 1975
8. Kolamn, Busby and Ross, “ Discrete Mathematical Structures ” , 3/ed , PHI ,1996
9. Fraleigh J.B., “ A First Course in Abstract Algebra Narosa ” ,1990
- 10 Smullyan R.M., “First Order Logic Springer Verlag” , 1968

Reference :

1. Lipschutz – 2000 Solved Problems in Discrete Mathematics , TMH
2. Balakrishnan – Graph Theory (Schaum) , MH
3. Hararay – Graph Theory



DISCRETE MATHEMATICAL STRUCTURE

Code : M(MCA)101

Contacts : 3L+ 1T

Credits : 4

Set Theory :

Set and Sub-set , Laws of Algebra of set, Counting and Venn Diagram, Inclusion and Exclusion Principles, Finite and Infinite Sets, Countably Infinite set. Principle of Mathematical Induction. 4L

Idea of Fuzzy set :

Union, Intersection and Complement. 2L

Mapping and Relation :

Injunctive , Surjective, Bijective Mapping (Definition and Simple Example), Relation, Equivalence Relation, Partition, Poset , Lattice, Distributing Lattice, Boolean Algebra (Definition and Simple Example), Propositional Logic, Logical Equivalence, Validity of Arguments. 10L

Combinatorics :

Principle of Counting , Permutation and Combination, Pigeon Hole Principle , Generalized Pigeon Hole Principle and their Simple Application. Generating Functions, Recurrence Relation. 10L

Formal Language and Finite Automata :

Construction and Conversion of NDFSA, DFA, State minimization. Mealy M/C, Moore M/C, Turing M/C , Regular Expression and Grammars – Type 0,1,2,3. 10L

Graph Theory :

Basic Concept , Digraph, Sub–Graph, Walk, Path , Circuit , Tree, Binary Tree, Spanning Tree, Isomorphism of Graph. 14L

Total 48L

Books :

1. Theory of Computer Science , Mishra & Chandrasekharan, PHI
2. Discrete Mathematics for Comp. Scientist & Mathematicians, Mott, Kandel & Baker, PHI
3. Discrete Mathematical Structure, C.L.Liu, TMH
4. Discrete Mathematical Structure, G.S.Rao, New Age International



5. Discrete Mathematics With Applications, Rosen , TMH, 5th Ed
6. Discrete Mathematics, Ash & Ash , MH
7. Discrete Mathematical Structure , Somasundaram , PHI
8. Discrete Mathematical Structure, Dubey , Excel Books
9. Discrete Mathematics , Iyenger , VIKAS
10. Discrete Structure and Graph Theory , Bhisma Rao , Scitech
11. Invitation to Graph Theory , Arumugam, Scitech
12. Discrete Structure and Graph Theory , S.K.S. Rathore, EPH



STATISTICAL AND NUMERICAL TECHNIQUES

Code : M(MCA)301

Contacts : 3L+ 1T

Credits : 4

Basic Statistics :

Measure of central tendency ; Dispersion ; Probability. 10L
Distribution : Introduction to Probability mass function, Probability density function,
Distribution function (Binomial , Poisson Normal).
Estimation of Parameters , Concept of unbiasedness and consistency, Application to given samples.

Interpolation :

Difference Operator, Difference Table , Shift Operator , Propagation of Error, 4L
Newton's Forward and Newton's Backward Interpolation Formula, Lagrange's
Interpolation .

Numerical Differentiation :

For Newton's Forward and Backward Formula. 1L

Numerical Integration :

Trapezoidal Rule (composite), Simpson's 1/3 rd Rule (composite), 5L
Romberg Integration.

Solution of Transcendental Equations :

Method of Iteration, Method of Bisection, Newton-Raphson Method, 6L
Regula-Falsi Method, Secant Method.

Solution of System of Linear Equations :

Gauss Elimination Method, Gauss-Jordan Method, Gauss-Seidel Method , 8L
LU Factorization Method.

Least Square Curve Fitting :

Linear & Non-Linear 4L

Solution of Differential Equations :

Picard's Method , Euler's Modified Method , Taylor's Series Method , 10L
Runge-Kutta Method, Adams-Moulton Method.

Total 48L

Books :

1. Numerical Analysis, Shastri, PHI
2. Numerical Analysis, S. Ali Mollah



3. Numerical Analysis, James B. Scarborough
4. Numerical Methods for Mathematics , Science & Engg., Mathews, PHI
5. Numerical Analysis, G.S.Rao , New Age International
6. Programmed Statistics (Questions – Answers), G.S.Rao , New Age International
7. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH
8. Computer Oriented Numerical Mathematics, N.Dutta, Vikas
9. Numerical Methods, Arumugam, Scitech
10. Probability and Statistics for Engineers, Rao , Scitech
11. Numerical Methods in Computer Application, Wayse, EPH



STATISTICS AND NUMERICAL ANALYSIS LAB (PRACTICAL)
[(CORRESPONDING TO M(MCA)301)]

Code : M(MCA)391

Contacts : 4P

Credits : 3

Programs to be written through C- language.

1. Assignments on Interpolation : Newton forward & backward, Lagrange
2. Assignments on Numerical Integration : Trapezoidal Rule , Simpson's 1/3rd Rule , Weddle's Rule
3. Assignments on Numerical solution of a system of Linear Equation Gauss elimination, Gauss–Jordan, Matrix Inversion, Gauss-Seidel
4. Assignments on Solution of Algebraic Equation : Bisection, Secant, Regula-Falsi, Newton-Raphson.
5. Assignments on Solution of Ordinary Differential Equation : Taylor Series, Euler's Method, Runge–Kutta Method
6. Assignments on Statistics Problem : Mean , Median, Mode, Standard deviation (for discrete & interval-type data), Correlation & Regression.



NUMERICAL METHODS AND PROGRAMMING

Code : M(CS)312

Contacts : 3L

Credits : 3

Computer Number System ; Overflow and underflow ;
Approximation in numerical computation; Truncation and round-off errors; 2L
Propagation and control of round-off errors ; Chopping and rounding off errors ;
Pitfalls (hazards) in numerical computations (ill conditioned and well conditioned
problems).

**Algorithmic Approach in C Language to all the Numerical Problems discussed below
must be followed :**

Interpolation :

Lagrange's Interpolation , Newton's forward & backward Interpolation Formula . 4L
Extrapolation ; Newton's Divided Difference Formula ; Error ; Problems.

Numerical Differentiation :

Use of Newton's forward and backward interpolation formula only. 1L

Numerical Integration :

Trapezoidal formula (composite) ; Simpson's $1/3^{\text{rd}}$ formula (composite) ; 2L
Romberg Integration (statement only); Problems.

Numerical Solution of System of Linear Equations :

Gauss elimination method ; Matrix Inversion ; Operations Count ; LU 6L
Factorization Method (Crout's Method) ; Gauss-Jordan Method ; Gauss-Seidel
Methods ; Sufficient Condition of Convergence.

Numerical Solution of Algebraic and Transcendental Equations :

Iteration Method : Bisection Method ; Secant Method ; Regula-Falsi Method; 4L
Newton-Raphson Method.

Numerical solution of Initial Value Problems of First Order

Ordinary Differential Equations :

Taylor's Series Method ; Euler's Method ; Runge-Kutta Method (4^{th} order) ; 6L
Modified Euler's Method and Adams-Moulton Method.

C Language Overview :

Loop ; Recursion; Function ; Array; Pointers; Structures and Unions ; Various 11L
types of File Access Methods ; Sequential, Indexed Sequential, Random ; Binary.
Various types of Files in C and Various types of File Handling Statement in C

Total 36L

Implementation above Numerical & Statistical Problems in C Language :



Text Books :

1. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH, 1st ed.
2. C Language and Numerical Methods by C.Xavier
3. Introductory Numerical Analysis by Dutta & Jana
4. Numerical Methods : Balagurusamy
5. Numerical Mathematical Analysis by J.B. Scarborough
6. Numerical Methods (Problems and Solution) by Jain, Iyengar & Jain
7. Numerical methods Computer Applications – P.U. Wayse. EPH
8. Computer Oriented Numerical Methods – Dutta, N. , Vikas
9. Numerical Methods with Programs in Basic , Fortran Pascal & C++ S.B Rao, University Press
10. Computer Programming & Numerical Analysis – N. Dutta, Universities Press
11. Numerical Methods for Engineers – Gupta , New Age International
12. Numerical Solutions of Differential Equations – Jain M.K., New Age International
13. Numerical Methods for Scientific & Engg. Computation – Jain M.K. , New Age International
14. Numerical Analysis – Rao G.S., New Age International
15. Discrete Mathematical Structures – Rao G.S., New Age International
16. foundations of Discrete Mathematics – Joshi K.D., New Age International
17. Applied Discrete Structure – Joshi, New Age International
18. Group, Rings & Modules with Application – Adhikari, M.r., Universities Press.



**NUMERICAL METHODS & PROGRAMMING LAB
(PRACTICAL)
[(CORRESPONDING TO M(CS)312)]**

Code : M(CS)382

Contacts : 3P

Credits : 2

1. Assignments on Interpolation : Newton forward & backward, Lagrange.
2. Assignments on Numerical Integration : Trapezoidal Rule, Simpson's $1/3^{\text{rd}}$ Rule, Weddle's Rule.
3. Assignments on Numerical solution of a system of Linear Equations : Gauss elimination, Gauss-Jordan, Matrix Inversion, Gauss-Seidel.
4. Assignments on Solution of Algebraic Equations: Bisection, Secant, Regula-Falsi, Newton-Raphson Methods.
5. Assignments on Ordinary Differential Equations: Taylor Series, Euler's Method, Runge-Kutta (4^{th} Order).
6. Assignments on Statistical Problems : Mean, Median, Mode , Standard deviation (for simple & frequency type data), Linear Correlation & Regression.



OPERATIONS RESEARCH AND OPTIMIZATION TECHNIQUES

Code : M(CS)402
Contacts : 3L+1T
Credits : 4
Allotted Hrs. : 48L

Introduction :

Introduction to OR Modeling Approach and Various Real Life Situations 2L

Linear Programming Problems (LPP) :

Basic LPP and Applications ; Various Components of LP Problem Formulation 2L

Solving Linear Programming Problems :

Solving LPP : Using Simultaneous Equations and Graphical Method ; Simplex Method ; Duality Theory ; Charnes' Big – M Method . Transportation Problems and Assignment Problems. 19L

Network Analysis :

Shortest Path : Dijkstra Algorithm ; Floyd Algorithm ; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded) . 7L

Inventory Control :

Introduction ; EOQ Models ; Deterministic and probabilistic Models ; Safety Stock ; Buffer Stock. 5L

Game Theory :

Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems (statement only); Games without saddle point ; Graphical Method ; Principle of Dominance. 6L

Queuing Theory :

Introduction ; Basic Definitions and Notations ; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson Queue Models : M/M/1 : ∞ /FIFO and M/M/1: N/ FIFO. 7L

Total 48L

Text Books :

1. H.A. Taha, “ Operations Research”, Fifth Edn. Macmillan Publishing Company, 1992.

References :

1. V.K.Kapoor – “ Operations Research”
2. Kanti Swaroop – “ Operations Research”



3. Hadley G., “Linear Programming” Narosa Publishers, 1987
4. Hillier F. & Liebermann G.J., “Introduction to Operations Research” 7/e (with CD) , THM
5. Hillier F.& Liebermann G.J., “Operations Research”, Holder Day Inc, 1974
6. Mustafi : Operations Research, New Age International
7. Mital : Optimization Methods, New Age International
8. Shenoy : Operations Research for Management , New Age International
9. Mahapatra : Introduction to System Dynamics Modelling, Universities Press
10. Rao : Engineering Optimization , New Age International
11. Schaum Outline Series – “Operations Research” , TMH



OPERATIONS RESEARCH AND OPTIMIZATION TECHNIQUES

Code : M(CS)511
Contacts : 3L+1T
Credits : 4
Allotted : Hrs. : 48L

Introduction :

Introduction to OR Modeling Approach and Various Real Life Situations 2L

Linear Programming Problems (LPP) :

Basic LPP and Applications ; Various Components of LP Problem Formulation 2L

Solving Linear Programming Problems :

Solving LPP : Using Simultaneous Equations and Graphical Method ; Simplex Method; Duality Theory; Charnes' Big-M Method. Transportation Problems and Assignment Problems. 19L

Network Analysis :

Shortest Path : Dijkstra Algorithm ; Floyd Algorithm ; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Crashing, Cost Analysis, Resource Allocation excluded). 7L

Inventory Control :

Introduction ; EOQ Models ; Deterministic and Probabilistic Models ; Safety Stock ; Buffer Stock. 5L

Game Theory :

Introduction ; 2-Person Zero-sum Game ; Saddle Point ; Mini-Max and Maxi-Min Theorems (Statement only) ; Games without Saddle Point ; Graphical Method ; Principle of Dominance. 6L

Queuing Theory :

Introduction ; Basic Definitions and Notations ; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson Queue Models : M/M/1 : ∞ /FIFO and M/M/1: N/ FIFO. 7L

Total 48L



Text Books :

1. H.A. Taha, “Operations Research”, Fifth Edn. Macmillan Publishing Company, 1992.

References :

1. V.K.Kapoor – “Operations Research”
2. Kanti Swaroop – “Operations Research”
3. Hadley G., “Linear Programming” , Narosa Publishers, 1987
4. Hillier F. & Liebermann G.J., “Introduction to Operations Research” 7/e (with CD) , THM
5. Hillier F. & Liebermann G.J., “Operations Research”, Holder Day Inc, 1974
6. Mustafi : Operations Research, New Age International
7. Mital : Optimization Methods, New Age International
8. Shenoy : Operation Research for Management , New Age International
9. Mahapatra : Introduction to System Dynamics Modelling, Universities Press
10. Rao : Engineering Optimization , New Age International
11. Schaum Outline Series – “Operations Research” , TMH



**OPERATIONS RESEARCH LAB (PRACTICAL)
[CORRESPONDING TO M(CS)511]**

Code: M(CS) 581

Contacts : 3P

Credits : 2

Software based lab using C and FORTRAN

For FORTRAN :

1. Familiarization with FORTRAN (3)
2. Linear Programming [Transportation (Northwest Corner Rule , Least Cost)] Assignment, Duality, Simplex)

For C-Language :

1. Shortest Path (Dijkstra's, Floyd's algorithm)
2. Maximal Flow
3. PERT / CPM
4. Queuing Theory

N.B : - Familiarization with any O.R. package .



**CIVIL ENGINEERING – III SEMESTER
MATHEMATICS**

Code: M(CE) 301

Contacts : 3L+1T

Credits : 4

Fourier Series and Fourier Transform :

Periodic functions, Euler's formulae. Fourier series of Odd and Even functions and functions with arbitrary period. Half Range Series. Fourier sine and cosine Transforms. Fourier Integrals. Application of Fourier series to forced vibration problems. 14L

Partial Differential Equations (PDE) :

Basic concepts, solutions of PDE (1D & 2D, Cartesian). Solutions by integral transform and separation of variables. Derivation of one dimensional wave equation (vibrating string) and its solution by using the method of separation of variables. D'Alembert's solution of wave equation. Derivation of heat conduction equation using Gauss divergence theorem (2D) and its solution by separation of variables. Solution of Laplace's equation (2D) by separation of variables. 20L

Introduction to Probability :

Finite sample space, conditional probability and probability of independent events. Bayes' Theorem ; One Dimensional random variables. Mean and Variance. 10L

Distribution : Binomial, Poisson, Uniform, Normal. Simple problems.

Two and Higher Dimensional Random Variables :

Correlation Coefficient and Regression. 4L
Chebyshev Inequality.

Total 48L

Text Books :

1. Murray R. Spiegel : Vector Analysis. Vector Analysis, Edn.1959, Schaum Publishing Co.
2. Erwin Kreyzig : Advanced Engineering Mathematics – Fifth Edn.1985, Willey Eastern.
3. P.L. Meyer : Introduction to Probability and Statistical Applications, Second Edn. 1979, Amerind Publishing Co.

Reference Books :

1. Bengamine A.R. and Cornell C.A : Probability and Statistics, Second Edn. 1970, McGraw Hill
2. Ang. A.H.S. and Tang V.H. : Probability Concepts in Engineering , Planning and Design , Vols. I and II , John Willey.
3. Hogg and Craig ; Introduction of Mathematical Statistics, Fourth Edn.195 Macmillan International.
4. B.S.Grewal : Higher Engineering Mathematics, Edn.1989 , Khanna Publishers.



QUANTITATIVE METHODS – 1

Code : M(MBA)105

Contacts :3L

Credits : 3

Course Contents

Set Theory (Finite)	3L
Permutations and Combinations	4L
Basic Concepts of Probability , Conditional Probability and Bayes' Theorem	4L
Determinant : Properties of Determinant (statement only) , Simple	5L

Examples ;

Matrices : Sum, Product of Matrices , Inverse of a Matrix, Simple Examples ;
Solution of a system of equations.

Introduction to Coordinate Geometry (2D), Straight lines and Circles	5L
Functions , Limits and Continuity	3L
Derivatives, Applications of Derivatives – Maxima and Minima	4L
Techniques of Integration – Method of Substitution, Integration By Parts	2L
Definite Integral and Area Under the Curve	2L
Sequences – Convergence, Calculation of Limits ; Infinite Series – Test for Convergence (Comparison Tests), D'Alembert Ratio Test and Cauchy Root Test.	4L

Total 36L

Readings :

1. G.B. Thomas and R.L. Finney – Calculus and Analytic Geometry, Addison Wesley Longman .
2. N.I. Piskunov – Differential and Integral Calculus , Vol. I and II , Mir Publishers
3. R.I. Levin and D.S. Rubin – Statistics for Management , Prentice Hall
4. J.E. Freund – Mathematical Statistics, Prentice Hall
5. K.B. Sinha et. al. – Understanding Mathematics , Universities Press.



QUANTITATIVE METHODS

Code : M(MBA)203

Contacts :3L

Credits : 3

Introduction :

Scope, Functions & Limitations. 1L

Collection and Presentation of Data :

Tabular & Diagrammatic Presentation, Frequency Distribution. 2L

Measures of Central Tendency and Measure of Dispersion :

Mean, Median, Mode, Quartiles ; Mean Deviation, Standard Deviation, Moments , Central Moments ; Skewness & Kurtosis 7L

Correlation Analysis :

Scatter Diagram, Linear Correlation, Rank Correlation, Simple Regression Analysis . 4L

Discrete Probability Distributions :

Introduction, Binomial & Poisson Distributions and their Properties & Applications, Expectation and Variance of these Distributions. 4L

Continuous Probability Distributions :

Uniform & Normal Distributions and their Properties & Applications, Expectation & Variance (statement only). 4L

Sampling :

Simple Random Sampling, Stratified Sample and their Applications 3L

Sampling Distribution :

Idea of Chi-square Distribution, Goodness of Fit (problems only), T and F Distribution and their application. 3L

Estimation :

a) Point Estimation b) Interval Estimation 4L

Testing of Hypotheses :

Simple and Composite hypotheses, Critical Region, Level of Significance , Type I and Type II errors ; Best Critical Region, Comparison of Binomial Populations and Normal Populations, Testing of Equality of Means. 4L

Total 36L

Readings :

1. R.I. Levin & D.S Rubin : Statistics for Management : Prentice Hall / Pearson Education
2. R.S. Bharadwaj, Business Statistics, Excel Books



3. P.C. Tulsian, Quantitative Techniques, Pearson Education
4. Rao , Quantitative Techniques in Business , Jaico
5. Anderson , Statistics for Business & Economics , 8th Edn, Thomson Learning
6. Kothari Quantitative Techniques , Vikas
7. S. P. Gupta & M.P. Gupta : Business Statistics : Sultan Chand & Sons.
8. A. Mood, F.M. Graybill & D.C. Boes : Introduction to the theory of Statistics : TMH.
9. John E . Freund : Mathematical Statistics : Prentice Hall
10. A.M. Goon, M.K. Gupta & B. Dasgupta : Basic Statistics : World Press.
11. N.G . Das : Statistical Methods : M . Das & Co.



OPERATIONS RESEARCH

Code : M(MBA)205

Contacts :3L

Credits : 3

Course Contents

LINEAR PROGRAMMING :

Construction of LP Models ; Graphical LP Solution ; Simplex Method; 17L
Cahrnes' Big – M Method; Duality
Construction of Transportation and Assignment Models; Transportation
Algorithm; Hungarian Method for the Solution of Assignment Problem.

DECISION ANALYSIS :

Decision Making under Certainty; Decision Making under Risk and Uncertainty 3L

GAME THEORY

Construction of Game Theory Models; Solution of two–person zero-sum 3L
games.

QUEUING THEORY :

M/M/1 : ∞ /FIFO Queues and Applications ; M/M/1 : N / FIFO Queues and their 5L
Applications.

SIMULATION MODELS :

Construction of Simulation Models; Generation of Random Numbers from 3L
Discrete Distributions.

REPLACEMENT MODELS :

Replacement of Capital Equipment that Deteriorates with Time – Without 5L
considering Time Value of Money and With Time Value of Money.
Replacement of Items that completely fail – Individual vs Group Replacement.

Total 36L

Readings :

1. Taha, H.A. : Operations Research – An Introduction, Prentice Hall /
Pearson Education
2. Hillier , F.S. and Lieberman, G.J. : Operations Research , TMH
- 3 Panneersalvam, Operations research , PHI
4. Anderson, Quantitative Methods for Business , 8th Edn. Thomson Learning
- 5 Prabha, Random Processes & Queuing Theory , Scitech
6. Kothari, Operations Research, Vikas
7. Anderson, Introduction to Management Science, 10th Edn. Thomson Learning



8. L.C.Jhamb, Quantitative Techniques (Vol. 1 & 2), EPH
9. Bazaraa M., Jarvis J., and Sherali M. : Linear Programming and Network Flows, Willey.
10. Sharma, J.K. : Fundamentals of Operations Research , Macmillan
11. Srivastava U.K., Shenoy G.V. and Sharma S.C. : Quantitative Techniques for Managerial Decisions, New Age International.
12. Render B. Stair R. M. Jr Hanna M. E. : Quantitative Analysis for Management, Pearson Education / PHI



APPLIED MATHEMATICS

Code : M(CT)301

Contacts :3L

Credits : 3

Calculus of Complex Variable :

Functions, Limits and Continuity , Analytic Functions, Cauchy-Riemann Conditions, Analytic Continuation, Complex Integration and Cauchy's Theorem, Cauchy's Integral Formula, Taylor's and Laurent Series , Zeros of an Analytic Function ; Poles, Essential Singularities, Residue Theorem (statement only)and its application to evaluation of integral , Introduction to conformal Mapping, Simple problems. 6L

Fourier Series :

Introduction: Euler's formula; Problems on general Fourier Series; Conditions For Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even And Odd functions; Change of interval; Half range series; Typical Waveforms (Square, Saw-toothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity (statement only); Fourier Transform (FT) and its Properties; Inverse Fourier Transform (statement only); Fourier transform of derivative (statement only); Convolution (statement only); Application of Fourier Transform in solving partial differential equations –Laplace's Equation (2D only) ,Heat Conduction Equation (1D only) and Wave Equation (1D only). 10L

Partial Differential Equations (PDE) and its Applications :

Introduction, linear and nonlinear equations of first order ; examples; homogeneous linear equations with constant coefficients and variable coefficient of second order, Separation of variables, Formulation and solution of wave equation ; one-dimensional heat flow equation and solution ; two-dimensional heat flow equation and solution. 10L

Probability and Statistics:

Mean, Median , Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability Distributions- Probability mass function; Probability density function; Distribution Function; Expectation; Variance ; Probability Distribution – Binomial, Poisson and Normal, Correlation and Regression; Method of Least Squares; Linear Curve Fitting. 10L

Total 36L



Text Books:

1. Rathor, Choudhari : Discrete Structure and Graph Theory.
2. Gupta S.C. and Kapoor V.K. : Fundamentals of Mathematical Statistics – Sultan Chand & Sons.
3. Lipschutz S; Theory & Problems of Probability (Schaum’s Outline Series)- McGraw Hill Book Co.
4. Spiegel M.R : Theory & Problems of Probability and Statistics (Schaum’s Outline Series)- McGraw Hill Book Co.
5. Goon A.M., Gupta M.K. and Dasgupta B: Fundamental of Statistics – The World Press Pvt. Ltd.
6. Spiegel M.R. : Theory and Problems of Complex Variables (Schaum’s Outline Series) McGraw Hill Book Co.
7. Bronson R : Differential Equations (Schaum’s Outline Series) McGraw Hill Book Co.
8. Ross S.L. : Differential Equations – John Willey & Sons
9. Sneddon I.N. : Elements of Partial Differential Equations - (McGraw Hill Book Co.)
10. West D.B. : Introduction to Graph Theory – Prentice Hall
11. Deo N : Graph Theory with Applications to Engg. and Computer Science – Prentice Hall
12. Grewal B. S. : Higher Engineering Mathematics (Thirtyfifth edn) Khanna Pub.
13. Kreyzig E: Advanced Engineering Mathematics – John Willey & Sons.
14. Jana – Undergraduate Mathematics
15. Lakshminarayan – Engineering Math 1.2.3
16. Gupta – Mathematical Physics (Vikas)
17. Singh – Modern Algebra
18. Rao B. : Differential Equations with Applications & Programmes, Universities Press
19. Murray : Introductory Courses in Differential Equations, Universities Press
20. Delampady , M : Probability & Statistics, Universities Press
21. Prasad : Partial Differential Equations, New Age International .
22. Chowdhury : Elements of Complex Analysis, New Age International
23. Bhat : Modern Probability Theory, New Age International
24. Dutta : A Text Book of Engg. Mathematics Vol. 1 & 2 , New Age International
25. Sarveswa, Rao : Engineering Mathematics Universities Press
26. Dhama : Differential Calculus, New Age International



COMPUTER SCIENCE & OPERATON RESEARCH

Code : M[CS(CT)]401

Contacts :3L + 1T

Credits : 4

N.B. : The Computer Science Course is already in the Syllabus and hence is not repeated here. Only O.R. Syllabus is given below.

Introduction :

Introduction to OR Modeling Approach and Various Real Life Situations 2L

Linear Programming Problems (LPP) :

Basic LPP and Applications; Various Components of LP Problem Formulation 2L

Solving Linear Programming Problems :

Solving LPP : Using Simultaneous Equations and Graphical Method ; Simplex Method; Duality Theory; Charnes' Big-M Method. Transportation Problems and Assignment Problems. 16L

Inventory Control :

Introduction ; EOQ Models; Deterministic and Probabilistic Models ; Safety Stock ; Buffer Stock. 4L

Total 24L

Text Book

H.A. Taha, "Operations Research ", Fifth Edn. , Macmillan Publishing Company, 1992

References:

1. Kanti Swaroop – "Operations Research "
2. Hadley G., "Linear Programming ", Narosa Publishers, 1987
3. Hillier F. & Liebermann G.J., "Introduction to Operations Research ", 7/e (with CD), THM
4. Hillier F. & Liebermann G.J., "Operations Research ", Holder Day Inc,1974
5. Mustafi : Operations Research , New Age International
6. Shenoy : Operations Research for Management, New Age International
7. Schaum Outline Series – " Operations Research", TMH