Maharshi Dayanand University Rohtak

Ordinance, S.O.E. and Syllabus of M.Sc. Mathematical Statistics (Ist & IInd Semesters) Examinations

Session — 2008-2009

Available from:

D.R. (Publication)
Maharshi Dayanand University
Rohtak-124 001 (Haryana)

Price :

At the Counter : Rs. 50/-
By Regd. Parcel : Rs. 75/-
By Ordinary Post : Rs. 60/-

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
DEPARTMENT OF STATISTICS
Scheme of Examination for M. Sc. (Mathematical Statistics) w.e.f.. 2008-09

The duration of the course of instructions for M. Sc. (Mathematical Statistics) degree shall be of two years (Four Semesters) There will be five theory papers and two practicals in each Semester. In addition to the thoery and practicals students will have to submit a project work in M. Sc. Second year. The detailed scheme of examination for M. Sc. (Mathematical Statistics) (First Year and second year) is as below :-

M. Sc. First Year

1st Semester

Paper	Max. Marks	Internal Assessment	Time Allowed	Teaching hrs. per week
Paper-I Measure Theory and Laplace Transforms	64	16	3 hrs.	04
Paper-II Probability Theory	64	16	3 hrs.	04
Paper-III Statistics Method	64	16	3 hrs.	04
Paper-IV Numerical Methods and Computer Programming	64	16	3 hrs.	04
Paper-V Applied Statistics-I	64	16	3 hrs.	04

Practical

Paper-VI Based on Papers III&V	50	---	04 hrs.	04 per group
Paper-VII Based on IV	50	---	04 hrs.	04 per group

2nd Semester

Paper	Max. Marks	Internal Assessment	Time Allowed	Teaching hrs. per week
Paper-VIII Complex Analysis and Linear Algebra	80	16	3 hrs.	04
Paper-IX Statistical Inference-I	80	16	3 hrs.	04
Paper-X Computer Programming	80	16	3 hrs.	04
Paper-XI Sampling techniques	80	16	3 hrs.	04
Paper-XII Applied Statistics-II	80	16	3 hrs.	04

Practical

Paper-XIII Based on Papers IX&X	50	---	04 hrs.	04 per group
Paper-XIV Based on XI & XII	50	---	04 hrs.	04 per group

3rd Semester

Paper	Max. Marks	Internal Assessment	Time Allowed	Teaching hrs. per week
Paper-XV MultivariateAnalysis	64	16	3 hrs.	04
Paper-XVI Designs of Experiments	64	16	3 hrs.	04
Paper-XVII Linear Programming	64	16	3 hrs.	04
Paper-X VIII & XIX Any two of the following :-				
Opt. (i) Stochasitic Processes	64	16	3 hrs.	04
Opt. (ii) Methods of Operations Research	64	16	3 hrs.	04
Opt. (iii)Officials Statistics	64	16	3 hrs.	04
Opt. (iv)Advanced sample Surveys*	64	16	3 hrs.	04

Practical

Paper-XX Based on Papers XV	50	---	04 hrs.	04 per group
Paper-XXI Based on Papers XVI & XVII	50	---	04 hrs.	04 per group

4th Semester

Paper	Max. Marks	Internal Assessment	Time Allowed	Teaching hrs. per week
Paper-XXII Econometrics	64	16	3 hrs.	04
Paper-XXIII Statistical Inference- II	64	16	3 hrs.	04
Paper-XXIV Game Theory and Non-linear Programming	64	16	3 hrs.	04
Paper-XXV and paper XXVI. Any two of the following :-				
(i) Queueing Theory	64	16	3 hrs.	04
(ii) Advanced Design of experiments	64	16	3 hrs.	04
(iii) Clinical trials	64	16	3 hrs.	04
(iv)Statistical Genetics*	64	16	3 hrs.	04

Practical

Paper-XX VII Based on Papers XXII	50	---	04 hrs.	04 per group
Paper-XXVIII Based on Papers XXIII & XXIV	50	---	04 hrs.	04 per group

*Syllabi will be framed later on.

Project Work

The project work will start in the beginning of 'M.Sc. (Second year)' under approved Supervisors from amongst members of the staff. The last date for the submisssion of project work will be two months after the theory papers of IVth Semster. However the result may be communicated to the students. The evaluation will be done by single external examiner on the basis of project work and viva voce on five points grading system i.e. A+, A, B+, B and C. The Students securing C has to resumbmit his project work.

* This Scheme will be applicable for 'M. Sc. First Years' w.e.f. from 2008-09 and 'M. Sc. Second Year w.e.f. 2009-10.

Syllabus - Ist SEMESTER

Paper I : (Measure Theory and Laplace Transform)

Max. Marks : 64

Internal Assessment : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Measure on a field and ring. Probability Measure. Outer Measureability of sets. Class of Measurable sets. Construction of outer measure using sequential concerning classes. Lebesgue Measure. Construction of non-Measurable sets. Simple function. Measurable function as a random variable. Sequences and Algebra of Measurable functions.

Section - II

Approximation theorem of Measurable functions. Concept of almost every where (a.e.) and Almost uniform convergence. Egoroffs theorem. Lusin theorem. Convergence in measure. Fundamental in measure. F. Riesz theorem for convergence in measure.

Section - III

Integral of a measurable fucntion w.r.t. a measure. Bounded convergence theorem. Fatou's Lemma. Monotone convergence theorem. Singed measure. Jorden- Hann decomposition theorem. Random Nikodyn theorem (Statement only) and its applications to probability density function. Product measure. Iterated Integrals and Fubini theorem.

Section - IV

Basic properties of Laplace and Inverse Laplace transforms. Convolution theorem. Applications of Laplace transform to the solution of linear ordinary differential equations, partial differential equations and Intergal equations.

Difference Equations and thier solution with constant coefficients

Books recommended

1.	Burril, C. W.	Measure Theory and Probability
2.	Halmos, P.R.	Measure Theory
3.	Royden, H.L.	Real Analysis
4.	Munroe, M. E.	Introduction to Measure and Integration
5.	Kingman, J.F.C. and Taylor, S.J.	Introduction to Measure and Probabaility
6.	Williams, J	Laplace Transforms

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper II : (Probability Theory)

Max. Marks : 64

Internal Assessment : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Random Experiments, Sample Space, Events - Simple, Composite, Mutually Exclusive and Exhaustive Events, Various Definitions of Probability, Properties of probability function, Addition Theorem, Boole's and Bonferroni's

Inequalities, Conditional Probability, Multiplication Theorem, Baye's Theorem, Independence of Events.

Section - II

Random Variables and Distribution Functions, Probability mass function, Probability density function Two Dimensional Random Variables - Joint, Marginal and Conditional Distributions, Independence of Random Variables.

Moments of Random Variables - Expectation, Variance, Covariance, Conditional and Marginal Expectation.

Section - III

Probability and Moment Generating Function and their Properties, Characteristic Function and its properties, Continuity Theorem, Inversion Theorem, Uniqueness Theorem of Characteristic Function. Moment Inequalities of Holder, Minkowski, Jensen's, Cauchy - Schwartz and Lyapunov's.

Section - IV

Modes of Convergence - Convergence in Probability, almost surely, in the r^{th} mean and in distribution, their relationship. Probability Inequalities of Chebychev and Markov, weak Law of Large numbers- Chebychev's Bernoulli's and Khintchine's Weak Law of Large Numbers, necessary and sufficient conditions for the WLLN.

Borel Cantelli Lemma, Kolmogorov inequality, Strong law of large numbers - Kolmogorov's theorem. Central limit theorem, Lindeberg - levy and Demoivre - Laplace forms of CLT.

Books Recommended

1. Meyer P.L.- Introductory Probability and Statistical Applications (Addison Wesley)
2. Goon, A.M., Gupta, M.K. and Dasgupta. B. (1985) : An Outline of Statistical Theory, Vol. I (World Press).

3. Freund J.E. - Mathematical satistics (Prentice Hall)

4. Mukhopadhyaya P. (1996) Mathematical Statistics (New Central Book Agency)

5. Rohatgi, V.K. and Saleh, A.K. Md. E. (2003) : An Introduction to Probability and Statistics, Second Edn. John Wiley.

6. Feller, W. (1968) : An Introduction to Probability Theory and its Appplications , 3rd Edition, Vol. I, John Wiley & Sons.

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper III : (Statistical Methods)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Measures of Central tendency & Dispersion. Raw and Central Moments, Skewness and Kurtosis. Analysis of Categorical data Consistency of Categorical data, Independence and association of attributes.

Section - II

Principle of least squares, fitting of curves, correlation and regression, Correlation ratio. Interclass correlation, Partial and multiple correlations.

Section - III

Probability distributions : Binomial, Poisson, Multinomial, Hyper geometric, Geometric. Negative Binomial, Uniform, Exponential, Laplace, Cauchy, Beta, Gamma, Weibul, Normal (Univariate and bivariate) and Lognormal distributions.

Section - IV

Sampling distribution of Mean and Variance, Chi-square, Student's and Snedocer's 'F' Fisher's-Z distribution and their applications. Elementary ideas of Non-central distributions.

Books Suggested

1.	Meyer, P.L.	Introductory Probability and Applications
2.	Rohtagi, V.K.	An Introduction to Mathematical Statistics
3.	Mood A.M., Graybill, F.A. & Boes DC	Introduction to the theory of statistics
4.	Goon A.M., Gupta M.K. & Dasgupta B	Outlines of statistics Volume-I
5.	Mukhopadhayaya.P	Mathematical Statistics

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper IV : (Numerical Methods and Computer Programming)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Numerical differentiation and integration : Trapezodial, Simpson's I/3rd, Simpson's 3/8th Weddle's rule. Cote's formula, error estimation in integration formula. Simpson's I/3rd rule with end correction. Richardason extrapolation, Romberg integration. Boundary value problem.

Section - II

Evaluation of Eigen values and eigen vectors of matrices by Power and Jacobi method. Solution of ordinary differential equation; Taylor's method, Euler's Modified Euler's. Picard and Runga Kutta Method, Predictor - Corrector Methods, Admas - Moulton Method, Milne's method.

Section - III

Computer organization, Problem analysis, Algorithm development, Flow chart, Introduction to Fortran 77, Data type, operators and expressions, Assignment statement, Arithmetic and logical operation, List directed and Format- directed Input/ Output statement.

Section - IV

Control statements : Do Loops, Do Continue, IF Blocks, Unconditional Go To, IF (conditional), Go to Label and Conditional Go To Statement. STOP, RETUREN and END Statement, COMMON statement. Arrays, Dimension statement, user defined Function, Function Subprograms,

Subroutine subprograms, Builtin- Functions, Double precision type, Complex type.

Books Suggested

1.	Sastry, S.S.	Introduction to Methods of Numerical Analysis
2.	Nielson, K.L.	Methods of Numerical Analysis
3.	Ram Kumar	Introduction to Fortan-77
4.	R.S. Salaria	-do-
5.	V. Raja Ramen	Fortran -77
6.	Fortran-77	Schaum Series

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper V : (Applied Statistics-I)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Methods of obtaining demographic data, measurement of population at given time. Rates and Ratios, measurement of mortality : Crude death rate, specific death rate, standardized death rate, infant mortality rate. Construction of a complete life table and its uses. Abridged life tables; Kings

Method. Reed and Merrill's method. Greville's method, Chiang's method.

Section - II

Measurement of fertility : Crude birthrate, general fertility rate, age specific fertility rate. Total fertility rate, relation between TFR and CBR, gross reproduction rate and net reproduction rate, replacement index. Standardized fertility Rate. Structure of Population, Stable and Quasi stable populations analysis, intrinsic rate of growth. Population projection by component method and using Leslie matrix, Reduction of modality curves; Gompertz's and Makeham formula, logistic curve and its use in population projection.

Section - III

Demand analysis - laws of demand and supply, price and supply elasticity of demand. Partial and cross elasticity of demand. Income elasticity of demand. Utility function methods of determining demand and supply curves from Family budget and time series date, Leontief's Method, Pigou's Method. Engel curve and its different forms. Pareto's law of income distribution. Curves of concentration.

Section - IV

Index numbers and their construction, uses of index numbers. Price, Quantity and Value relatives, link and chain relatives, Laspeyer's Paashce's Marshall - Edge worth and Fisher's index Numbers, Chain base index numbers, Tests for index numbers. Cost of living index numbers.

Books Recommended

1. Biswas, S; Stochastic Processes in Demography Applications.
2. Goon A.M., Gupta M.K. Fundamentals of Statistics
   Das Gupta B (2001) Volume-II

3. Mukhopadhyay, P. (1999) Fundamental of Statistics Volume-II

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper VI Practicals will be based on Theory Papers III & V.

Paper VII Practicals will be based on Theory Paper IV.

The question paper will consist of five questions and the students will be required to attempt any three questions. The question paper will set on the spot jointly by the Internal and External Examiner.

Distribution of marks will be as follows :-

Marks for Question paper	:	36
Marks for Practical Record book	:	06
Marks for Viva-Voice	:	08
Total	:	50

2nd SEMESTER

Paper VIII : (Complex Analysis and Linear Algebra)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Functions of a Complex Variable and their Analytic properties. Cauchy's Riemann Equations. Elementary idea of Mobius transformation, Cross Ratio, Invariant Point and Critical point. Power series and its Radius of Convergence.

Section - II

Complex Line Integrals. Cauchy's theorem, Cauchy's Integral Formulae and Inequality. Morera's Theorem. Liouvelle's Theorem, Taylor and Laurent Series.

Section - III

Singularities and their classification. Poles and zeros of a meromorphic function. Argument principle. Rouches theorem. Fundamental Theorem of algebra. Residues : Cauchy's Residue Theorem application of Cauchy's Residue Theorem for evaluation of Integrals of Real valued functions.

Section - IV

Linear and orthogonal Transformation of a Matrix. Generalized Inverse of a matrix. Eigen values and Eigen vectors of a Liner Transformation. Quadratic Forms and their Reduction to Canonical Form. Signature of a matrix. Positive Definiteness Matrix.

Books Suggested

1. Copson, E.T. Introduction to the Theory of functions of a complex Variable

2.	Pati, T	Functions of A Complex Variable.
3.	Sharma, J.N. and Swarup, Shanti	Function of a Complex Variable
4.	Goyal and Gupta	Function of A Complex Variable. (Pargati Parkashan Meerut)
5.	Malik S.C.	Analysis (Jeevan Sons Publication, New Delhi)
6.	Data, K.B.	Matrix and Liner Algebra
7.	Hadley, G.	Liner Algebra
8.	Sushma, V.	Liner Algebra

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper IX : (Statistical Inference -I)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Problem of point estimation : Unbiasedness, Consistency, Sufficiency, Efficiency, Complete statistics, Complete Sufficient statistics. Factorization theorem, Exponential family of distributions and its properties, Minimum

- Variance unbiased estimator, MVU estimators, Rao Blackwell theorem. Lehman Schefe's theorem and its applications in finding UMVB estimators, Cramer- Rao, Bhattachary's Bounds.

Section - II

Method of estimation - Method of Maximum Likelihood and its properties, Methods of Moments and its properties, Method of Least Square and its properties. Method of Minimum Chi- square and Modified Minimum Chi- square.

Section - III

Testing of hypothesis : Basic concepts, Neyman theory of testing of hypothes, construction of most powerful test, Uniformly Most Powerful test, Uniformly Most Powerful Unbiasedness tests using N P Lemma. Neyman Structure and construction of M P similar test.

Section - IV

Likelihood ratio test : Derivation and its properties, asymptotic distribution of L.R. Test. Interval Estimation : Method of obtaining confidence intervals based on small and large samples. Unbiased and Shortest expected length confidence interval.

Books Suggested

1. Goon A.M., Gupta M.K. Outline of Statistics
   B.Das Gupta (2001) Volume-II
2. Kendall, M.G. and Straut, A., Advanced Theory of Statistics
3. Rohtagi, V.K. Theory of Mathematical Statistical
4. Rao, C.R. Linear Statistical Inference and its Applications.

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/

she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper X : (Computer Programming)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

History and features of C languages, Components of C Langauge data type : Basic data type, Enumerated data, types, Derived data types, variables declaration : Local Global parametric variables, Assignment of variables, Numeric character, real and string constants. Operators, type modifiers and expressions. Basic input/ Out put.

Section - II

Control statements, decision making statements, one dimensional, two dimensional and multidimensional arrays. Functions, classification of functions definition and declaration, assessing a function, Return statement. storage classes. Parameter passing in functions recursion in functions.

Section - III

Pointers; Pointers and array, Pointer and functions : Pointers to Pointers, Pointers to functions, function returning pointers, functions with variables number of arguments Preprocessor, structure and union.

Section - IV

Trees, Binary trees representation. Tree traversal,

Trees and their application Graphs Introduction, Unions representation sorting - Introduction, Inserting sort, Quick sort, Heap sort.

Books Suggested

1. Kernigham, Brain W and Ritchie, Dennis M. (1989) — The C Programming Language.
2. Knuth, Donald E. (2002) — The Art of Computer programming, Vol 2/ seminumerical Algorithms,
3. E. Balaguruswamy — Programming C
4. Yashwant Kanetkar — Let us C
5. R.S. Salaria — A Beginner;s Guide to Computer Programming with C

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/ she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper XI : (Sampling Techniques)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Sample versus complete enumeration. Designing of Sample surveys, Sources of errors in sample surveys, types

of non-response errors, probability and purposive sampling, simple random sampling with or without replacement for the estimation of mean total. Proportion and ratio, determination of sample size for specified precision, stratification. Construction of strata and determination of number of strata.

Section - II

Ratio Estimates, approximate variance, comparison with mean per unit stimate Conditions under which it is optimum, Bias of the ratio type estimate, unbiased ratio type estimate due to Hartley and Ross, Ratio Estimate in stratified sampling. regression Estimators (Pre- asigned and estimated from the sampling comparison with the ratio and mean per unit estimators in stratified sampling.

Section - III

Double sampling (two phase sampling) for ratio and regression methods of estimation. Systematic sampling, comparison with stratified and simple random sampling, single stage cluster sampling, variance in terms of inter cluster correlation. Jessen's cost function and determination of optimum sampling unit.

Section - IV

Sampling with varying probability, sampling with probability proportional to size, Lahiri's Method of selection unequal probability sampling with replacement and without replacement Horvitz Thomson estimator, Its variance and unbiased estimate of this variance. Two stage sampling, estimate of population Mean and its variance, optimum allocation for fixed cost.

Books Suggested

1. Chochran, W.G. — Sampling Techniques
2. Daroga Singh & F.S. Chaudhary — Theory & Analysis of Sample Survey
   Samplisurve designs

3. Hansen, Hurwitz and Madow Sample survey Methods
4. Mukhopadhyay, Primal Theory and Methods of Survey Sampling
5. Goon A.M. Gupta M.K. and Das Gupta Out line of Statistics Vol-II
6. P.V. Sukhatme & B.V. Sukhatme Theory and application of Sample Surveys

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper XII : (Applied Statistics - II)

Max. Marks : 64

Internal Assessment Marks : 16

Time : 3 hours

Teaching hours : 04 hrs. per week

Section - I

Analysis of time series, components of time series. Trend measurement by mathematical curves : Polynomial, Growth curves, Moving average method, Spencer's formulae. Effect of elimination of trend on other components of time series. Variate difference method and its use for estimation of variance of the random component. Measurement of Seasonal Fluctuations. Measurement of Cyclical Component; periodogram analysis.

Section - II

Concept of stationary time series, strong and weak stationary : Auto covariance and auto correlation. Correlogram of auto regressive scheme, moving average scheme and a Harmonic series. Box Jenkin's models. Estimation of parameters in ARIMA models, forecasting : exponential and adaptive Smoothing Models.

Section - III

Statistical quality control and its purposes, 3 sigma control limit, Shewart control chart. Control charts for variables and attributes. Natural tolerance limits and specifications limits; modified control limits. Sampling Inspection plan, Producer's and Consumer's risk, OC and ASN function, AQL. LTPD and ATI.

Section - IV

The single, double and sequential sampling plans and their curves viz AOQ, OC ASN and ATI curvers. The choice of sampling plans by attributes and by variables. Acceptance plan by variables, single and sequential sampling plans, acceptance sampling by variables (known and unknown sigma case).

Books Suggested

1.	M. G.Kindall	Time series
2.	Goon A.M., Gupta M.K.	
	Das Gupta , B.	Fundamentals of Statistics Vol. -2
3.	Montgomery, D.E.	Introduction to Statistical Quality Control
4.	Croxton and Cowden	Applied General Statistics
5.	Kendall M.G.and Stuart,A.	Advances in Statistics Vol-3
6.	Grant, E.L.	Statistics Quality Control, Wiley Eastern

Note : The Examiner is to set the question paper into five units - A, B, C, D, & E. In each unit A, B, C & D, he/she has to set two questions of 12 marks each from section I, II, III & IV respectively and the candidate will attempt one question from each unit. In unit E, there will be 8 short answered questions of 2 marks each, covering the whole syllabus and the candidate has to attempt all the questions.

Paper XIII Practicals will be based on Theory Papers IX & X.

Paper XIV Practicals will be based on Theory Papers XI & XII.

The question paper will consist of five questions and the students will be required to attempt any three questions. The question paper will set on the spot jointly by the Internal and External Examiner.

Distribution of marks will be as follows :-

Marks for Question Paper	:	36
Marks for Practical Record book	:	06
Marks for Viva-Voce	:	08
Total	:	50

systems, self-adjoint equations of second order.

Linear systems, Matrix method for homogeneous first order system of linear differential equations, fundamental set and fundamental matrix, Wronskian of a system, Method of variation of constants for a nonhomogeneous system with constant coefficients, nth order differential equation equivalent to a first order system (Relevant topics from the books by Ross, and Coddington and Levinson).

Section III (2 Questions)

Nonlinear differential system, plane autonomous systems and critical points, classification of critical points –

rotation points, foci, nodes, saddle points. Stability, asymptotical stability and unstability of critical points, almost linear systems, Liapunov function and Liapunov's method to determine stability for nonlinear systems.

Periodic solutions and FLoquet theory for periodic systems, limit cycles, Bendixson non-existence theorem, Poincare-Bendixson theorem (Statement only), index of a critical point. (Relevant topics from the books by Ross, and Coddington and Levinson).

Section IV (2 Questions)

Motivating problems of calculus of variations, shortest distance, minimum surface of revolution, Branchistochrone problem, isoperimetric problem, geodesic. Fundamental lemma of calculus of variations, Euler's equation for one dependant function and its generalization to 'n' dependant functions and to higher order derivatives, conditional extremum under geometric constraints and under integral constraints (Relevant topics from the book by Gelfand and Fomin).

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books recommended

1.	Jerri, A.J.	Introduction to Integral Equations with Applications
2.	Coddington, E.A. and Levinson, N.,	Theory of Ordinary Differential Equations, McGraw Hill, New York (1955).
3.	Ross, S.L.	Differential Equations, John Wiley and Sons Inc., New York, 1984.
4.	Boyce, W.E. and	Elementary Differential Equations and

Paper IV : Topology

Max. Marks : 80
Time : 3 hours

Section-I (2 Questions)

Statement only of (Axiom of choice, Zorn's Lemma, Well-Ordering theorem and continuum hypothesis).

Definition and examples of topological spaces, Neighbourhoods, Interior point and interior of a set, definition of Closed set as a complement of an open set, Adherent point (Closure point) and limit point (Accumulation point) of a set, definition of closure of a set as set of adherent (Closure) points, derived set of a set, properties of closure operator, boundary of a set, Dense subsets.

Base and sub-base for a topology, Neighbourhood system of a point and its properties, Base for Neighbourhood system.

Relative (induced) Topology and subspace of a topological space. Alternative methods of defining a topology in terms of 'Neighbourhod system', 'Interior Operator', 'Closed sets' and Kuratowski closure operator.

Comparison of Topologies on a set, About intersection and union of topologies on a set.

Definition, examples and characterizations of continuous functions. Open and closed functions, Homeomorphism.

Tychonoff product topology in terms of standard (defining) subbase, projection maps, Characterisation of product topology as smallest topology with projections continuous, continuity of a function from a space into a product of spaces.

Section-II (2 Questions)

First countable, Second countable and separable spaces, their relationships and hereditary property. About countability of a collection of disjoint open sets in a separable and second countable space, Lindelof theorems.

T_0, T_1, T_2, Regular and T_3 separation axioms, their characterization and basic properties i.e. hereditary property of T_0, T_1, T_2, Regular and T_3 spaces, and productive property of T_1 and T_2 spaces. Quotient topology w.r.t. a map, Continuity of function with domain a space having quotient topology, About Hausdorffness of quotient space (scope as in theorems 8-11, Chapter 3 of Kelley's book).

Completely regular and Tychonoff (T 3 ½), spaces, their hereditary and productive properties. Embedding lemma, Embedding theorem (Scope as in theorems 5-7, Chapter 4 of Keley's books).

Normal and T_4 spaces : Definition and simple examples, Normality of a regular Lindelof space, Urysohn's Lemma, complete regularity of a regular normal space, T_4 implies Tychonoff, Tietze's extension theorem.

Section-III (3 Questions)

Connected spaces : Separation of a topological space, definition of connectedness in terms of separation, Characterization of connectedness, connected subsets and their properties, Continuity and connectedness, Connectedness and product spaces. Components, locally connected spaces.

Compactness : Definition and examples of compact spaces and subsets, compactness in terms of finite intersection property (f.i.p.), continuity and compact sets, compactness and separation properties, Closedness of

compact subset and a continuous map from a compact space into a Hausdorff and its consequence, Regularity and normality of a compact Hausdorff space.

Compactness and filter convergence, compactness and product space. Tychonoff product theorem using filters, Tychonoff space as a subspace of a compact Hausdorff space and its converse, local compactness and one point compactification, Stone-Cech compactification, (Scope as in theorems, 1, 7, 11, 15, 17, 21-24, Chapter 5 of Kelley's book).

Filter on a set : Definition and examples, Collection of all filters on a set as a p.o. set, finer filter, methods of generating filters/finer filter, Ultra filter (u.f.) and its characterizations, Ultra Filter Principle (UFP) i.e. Every filter is contained in an ultra filter. Image of filter under a function.

Convergence of filters : Limit point (Cluster point) and limit of a filter and relationship between them, Continuity in terms of convergence of filters, Hausdorffness and filters, Convergence of filter in a product space. Compactness and filter convergence.

Section –IV (3 Questions)

Nets in topological spaces. Convergency of nets, Hausdorffness and nets, Subnet and cluster points, compactness and nets, canonical way of converting nets to filters and vice versa. (Scope as in theorems 2-3, 5-7 of chapter 2, theorem 2 of chapter 5 of Kelley's book).

Definition and examples of metrizable spaces, metrizability of product of countably many metrisable spaces, Urysohn's metrization theorem.

Metrization theorems and paracompactness : Local finiteness, Nagata-Smirnov Metrization theorem, paracompactness (Scope as in theorems 39.1-39.2, 40.3,

41.1-41.5 chapter 6 of Munkres' book. Fundamental group and covering spaces : Homotopy of paths, Fundamental group, covering spaces, Fundamental group of circle (Scope as in theorems, 51.1-51.2, 52.1-52.4, 53.1-53.3 and 54.1-54.5 of chapter 9 of Munkres' book.

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1. Munkres, J.R.	Topology, Pearson Education Asia, 2002.
2. Simmons, G.F.	Introduction to Topology and Modern Analysis. Student edition, McGraw Hill Book Company, 1963.
3. Willard, S.	General Topology, Addison-Wesley Publishing Company.
4. Kelley, J.L.	General Topology, Affiliated East West Press Pvt. Ltd., New Delhi.

Paper – V : Programming in C and Data Structure

Max. Marks : 80

Time : 3 hours

Section I (3 Questions)

An overview of programming. Programming language, Classification. Review of C essentials and operators (ANSI Features).

Two's compliment notation. Bit - Manipulation Operators. Bitwise Assignment Operators. Memory Operators.

Arrays and Pointers. Encryption and Decryption. Pointer Arithmetic. Passing Pointers as Function Arguments. Accessing Array Elements through Pointers. Passing Arrays as Function Arguments. Multidimensional Arrays. Arrays of Pointers. Pointers to Pointers.

Storage Classes –Fixed vs. Automatic Duration. Scope. Global variables. Definitions and Allusions. The register Specifier. ANSI rules for the Syntax and Semantics of the Storage-Class Keywords. Dynamic Memory Allocation.

Section II (3 Questions)

Structures and Unions. enum declarations. Passing Arguments to a Function, Declarations and Calls, Automatic Argument Conversions, Prototyping. Pointers to Functions. Complex Declarations.

The C Preprocessors. Macro Substitution. Include Facility. Conditional Compilation. Line Control.

Input and Output -Streams. Buffering. The <stdio.h> Header File. Error Handling. Opening and Closing a File. Reading and Writing Data. Selecting an I/O Method. Unbuffered I/O. Random Access. The Standard Library for Input/output.

Section III (2 Questions)

Introduction to data structure. Arrays. Stacks. Queues. Linked lists. Trees. Graphs.

Section IV (2 Questions)

File structures : Concepts of fields, records and files. Sequential file organization. ISAM. Hashing techniques. Inverted lists and multilists.

Sorting : Internal and external sorting. Search and merging techniques.

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1. Peter A. Darnell and Philip E. Margolis, C : A Software Engineering Approach, Narosa Publishing House (Springer International Student Edition) 1993.
2. Samuel P. Harkison and Gly L. Steele Jr., C : A Reference Manual, Second Edition, Prentice Hall, 1984.
3.. Brian W. Kernighan & Dennis M. Ritchie, The C Programme Language, Second Edition (ANSI features) , Prentice Hall 1989.
4. Balagurusamy E : Programming in ANSI C, Third Edition, Tata McGraw-Hill Publishing Co. Ltd.
5. Byron, S. Gottfried : Theory and Problems of Programming with C, Second Edition (Schaum's Outline Series), Tata McGraw-Hill Publishing Co. Ltd.
6. Loomis, Data Structure and File Management, Prentice Hall India Ltd.
7. Schaume's Outline Series, Data Structures, Tata McGraw Hill.
8. Tannenbaum, Data Structure Using C, Tata McGraw-Hill.

Paper VI : Operating System and Unix

Max Marks : 80
Time : 3 Hours

Section I (2 Questions)

Operating systems overview : Operating systems as an

extended machine and resource manager, Operating systems classification; Operating systems and system calls; Operating systems architecture.

Section II (3 Questions)

Process Management functions : Process model, hierarchies, and implementation; process states and transitions; multi-programming, multi-tasking, multi-threading; level of schedulers and scheduling algorithms, micro-kernel architecture.

Memory Management function : Memory management of single user operating systems partition, swapping, paging, segmentation, virtual memory.

Section III (3 Questions)

Device Management function : I/O devices and controllers, interrupt handlers, device independent I/O software, user-space I/O software; disk scheduling; clock hardware software; terminal input/output software. File management functions; file naming structure, types, access mechanisms, attributes and operations; hierarchical directory systems, directory structures and directory operations; file space allocations; file sharing, file locking; symbolic links; file protection and security; distributed file systems.

Current programming : Sequential and concurrent process; precedence graph, Bernsterins condition; time-dependency and critical code section, mutual exclusion problem; classical process co-ordination problems; deadlock handling, inter-process communication.

Section IV (2 Questions)

UNIX Operating System: Overview of UNIX operating system. Implementation of basic functions in UNIX operating system. Comparative study of operating systems.

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1. Milan Milankovic, Operating System, McGraw Hill.
2. Peterson and Solserchatz, Operating System Concepts, Addison Wesley.
3. Achyut S. Godbole, Operating System, Tata McGraw Hill.
4. H.M.I. Deitel, An Introduction to Operating Systems, Addison Wesley.
5. Ritchie. Operating System, BPB Publication.
6. Steven, Advanced Programming in UNIX Environment, Addison Wesley.

Paper VII : Practicals

Max. Marks : 80
Time 4 hours

The practical examination will be based upon Papers V and VI.

i) Viva-voce and practical record : 30 marks

ii) Written practical work : 50 marks

The examiner shall set a question paper consisting of 4 questions and the examinees will be required to attempt any two. They will write the programs in Answer-books and will run the same on computers and they will take printouts of programs and output.

2nd YEAR

Paper VIII : Integration Theory and Functional Analysis

Max. Marks : 80

Time : 3 Hours

Section I (2 Questions)

Normed linear spaces, Metric on normed linear spaces, Holder's and Minkowski's inequality, Completeness of quotient spaces of normed linear spaces, Completeness of l_p, L^p, R^n, C^n and C[a,b], Finite Dimensional Normed spaces, Compactness and finite Dimension, F. Riesz's Lemma.

Bounded linear transformation, Equivalent formulation of Continuity, Equivalent norms, Strong convergence and weak convergence, Continuous linear functional, Conjugate spaces.

Section II (3 Questions)

Hahn-Banach extension theorem (Real and Complex form), Riesz Representation theorem for bounded linear functionals on L^p and C[a,b], Second conjugate spaces. Reflexive spaces.

Uniform boundedness principle and its consequences. Open mapping theorem and its application. Projection. Closed Graph theorem.

Compact operators and its relation with continuous operator. Compactness of linear transformation on a finite dimensional space. Properties of Compact operators. Compactness of the limit of the sequence of Compact operators. The closed range theorem.

Section III (2 Questions)

Inner product spaces, Hilbert spaces, Schwarz's inequality, Polarization Identity, continuity of inner product, Hilbert space as normed linear space, Example of a Banach space which is not a Hilbert space, Convex sets in Hilbert

spaces, Orthogonal complements and direct sum, Projection theorem.

Orthonormal sets. Bessel's inequality. Parseval's identity. Gram- Schmide Orthogonalization.

Section IV (3 Questions)

Conjugate of a Hilbert space, Riesz representation theorem in Hilbert spaces. Adjoint of an operator on a Hilbert space. Reflexivity of Hilbert space. Self-adjoint operator. Positive operator. Normal and Unitary operators. Projections on Hilbert space. Spectral theorem on finite dimensional space.

Signed measure, Hahn decomposition theorem, Jordan decomposition theorem, Mutually signed measure, Radon-Nikomdym theorem, Lebesgue decomposition, Lebesgue-Stieltjes integral, Product measures, Fubini's theorem.

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books recommended

1. H.L. Royden, Real Analysis, McMillan Publishing Co., Inc., New York, 4th Edition, 1993.
2. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons.
3. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Company, 1963.
4. G.. Bachman and L. Narici, Functional Analysis, Academic Press, 1966.
5. R.R. Goldberg, Methods of Real Analysis, Oxford and

IBH Publishing Co., New Delhi.

Paper IX : Partial Differential Equations and Mechanics

Max. Marks : 80

Time : 3 hours

Section I (2 Questions)

Solution of three-dimensional Laplace equation by using the method of separation of variables in terms of Cartesian, cylindrical and spherical coordinates. Method of separation of variables to solve three- dimensional wave equation in Cartesian and spherical coordinates. Use of the method of separation of variables to find steady- state temperature in a rectangular plate, in a disk, in a bar with ends at different temperatures, in a semi-infinite bar, in an infinite plate, in a semi-infinite bar, in an infinite cylinder, in a solid sphere (Relevant topics from the books by Sneddon, and O'Neil).

Section II (3 Questions)

Kinematics of a rigid body rotating about a fixed point, general rigid body motion as a screw motion, moving axes.

Moments and products of inertia, Angular momentum of a rigid body, principal axes and principal moment of inertia of a rigid body, kinetic energy of a rigid body rotating about a fixed point, Momental ellipsoid and equimomental systems, coplanar mass distributions, general motion of a rigid body.

Two- dimensional rigid body dynamics – problems illustrating the laws of motion and impulsive motion.

(Relevant topics from the book of Chorlton).

Section III (2 Questions)

Constraints, holonomic and non-holonomic systems, Scleronomic and Rheonomic systems, Degree of freedom and

Generalised coordinates, possible and virtual displacement, possible velocity and possible acceleration, D' Alembert's principle, Lagrange's equations of the first kind, generalized forces, Lagrange's equations of the second kind, generalized velocities and accelerations. Uniqueness of solution, variation of total energy for conservative fields.

Lagrange's variable and Lagrangian function L(t, q_i, $\dot{q}_i$), Lagrange's equations for potential forces, generalized momenta p_i , Hamiltonian variable and Hamiltonian function H(t, q_i, p_i), Donkin's theorem, cyclic coordinates.

Section IV (3 Questions)

Hamilton canonical equations, Routh variables and Routh function R, Routh's equations, Poisson Brackets and their simple properties, Poisson's identity, Jacobi – Poisson theorem.

Hamilton action and Hamilton's principle, Poincare – certain integral invariant, Whittaker's equations, Jacobi's equations, Lagrangian action and the principle of least action, Lee Hwa-Chung's theorem (statement only).

Canonical transformation, necessary and sufficient condition for a canonical transformation, univalent Canonical transformation, free canonical transformation, Hamilton-Jacobi equation, Jacobi theorem, method of separation of separation of variables in HJ equation, Lagrange brackets, necessary and sufficient conditions of canonical character of a transformation in terms of Lagrange brackets, Jacobian matrix of a canonical transformation, conditions of canonicity of a transformation in terms of Poison brackets, Invariance of Poisson Brackets under CT.

Note :- Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1. F. Gantmacher — Lectures in Analytic Mechanics, MIR Publishers, Moscow, 1975.
2. P.V. Panat — Classical Mechanics, Narosa Publishing House, New Delhi, 2005.
3. N.C. Rana and P.S. Joag — Classical Mechanics, Tata McGraw- Hill, New Delhi, 1991.
4. Louis N. Hand and Janet D. Finch — Analytical Mechanics, CUP, 1998.
5. Sneddon, I.N. — Elements of Partial Differential Equations, McGraw Hill, New York.
6. O'Neil, Peter V. — Advanced Engineering Mathematics, ITP.
7. F. Chorlton — Textbook of Dynamics, CBS Publishers, New Delhi.
8. H.F. Weinberger — A First Course in Partial Differential Equations, John Wiley & Sons, 1965.

Paper X : Complex Analysis

Max. Marks : 80
Time : 3 Hours

Section I (3 Questions)

Functions of a complex variable. Analytic functions,

Cauchy-Riemann equations in cartesian and polar coordinates. Construction of analytic functions. Power series representation of an analytic function. Branches of many valued functions.

Complex integration. Integration along a regular arc. Cauchy-Goursat theorem. Cauchy's integral formula. Poisson's integral formula. Higher order derivatives. Morera's theorem. Cauchy's inequality. Liouville's theorem. The fundamental theorem of algebra. Taylor's theorem. Laurent's theorem.

Section II (2 Questions)

Zeros of an analytic function. Isolated singularities. Limiting points of zeros and poles. The point at infinity. Maximum modulus principle. Schwarz lemma. Meromorphic functions. Mittag-Leffler's expansion. The argument principle. Rouche's theorem.

Calculus of residues. Cauchy's residue theorem. Evaluation of integrals. Integrals involving many valued functions.

Section III (2 Questions)

Bilinear transformations, their properties and classifications. Definitions and examples of Conformal mappings.

Analytic Continuation. Natural Boundary. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation. Schwarz Reflection principle.

Section IV (3 Questions)

Integral Functions. Mittag-Laffler's theorem. Factorization of an integral function. Weierstrass' factorisation theorem. Canonical product. Jensen's formula. Poisson-

Jensen formula. Hadamard's three circles theorem. Growth and order of an entire function. An estimate of number of zeros. Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem.

Gamma function and its properties. Stirling formula. Riemann Zeta function. Riemann's functional equation.

Note :- Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.
2. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House, 1980.
3. E.T. Copson, An Introduction to the Theory of Functions of a Complex Variable, Oxford University Press, London.
4. E.C. Titchmarsh, The Theory of Functions, Oxford University Press, London.
5. L.V. Ahlfors, Complex Analysis, McGraw Hill, 1979.
6. S. Lang, Complex Analysis, Addison Wesley, 1977.
7. Mark J. Ablowitz and A.S. Fokas, Complex Variables : Introduction and Applications, Cambridge University Press, South Asian Edition, 1998.
8. S. Ponnusam, Foundations of Complex Analysis, Narosa Publishing House, 1997.
9. Ruel V. Churchill and James Ward Brown, Complex Variables and Applications, McGraw-Hill Publishing

Company.

Paper XI : Mathematical Modelling and Operations Research

Option (i)

Max. Marks : 80
Time : 3 Hours

Section I (3 Questions)

Measuring of Modelling. Some characteristics of Mathematical models. Models for finding the radius of the Earth, Motion of Planets, Distance of moon.

Population growth models. Effects of Immigration and Emigration on Population size, Decrease of Temperature, Diffusion change of price of a commodity, Logistic law of population growth, a simple Compartment model.

Mathematical Modeling of Epidemics

A simple Epidemics Model, A Susceptible – Infected - Susceptible (SIS) Model, SIS Model with constant numbers of carriers, Simple Epidemic Model with Carriers, Model with Removal, Model with Removal and Immigration.

Mathematical Modelling in Economics

Domar Macro model, Domar First Debt model, Domar's second Debt Model, Samuelson's Investment Model, Stability of Market Equilibrium.

Mathematical Modelling in Machine, Arms, Race, Battles : A Model for diabetes mellitus, Richardson's Model for arm Race, Lamechester's Combat model, Microbial Growth in a Chemostat.

Section II (2 Questions)

Mathematical Programming

Convex sets, convex functions and their properties. General linear programming problems – Assignment, Transportation, Medical diagnosis and Hospital Diet Problems : Formulation and their properties of solutions. Graphical and two phase simplex method. Problem of degeneracy in LPP and its resolution.

Duality in Linear programming : Symmetric and un-symmetric dual problems, economic interpretation of primal and dual problems, Fundamental duality theorem and dual simplex method.

Kuhn convex quadratic programming, Wolf's and Beal's methods.

Section III (2 Questions)

Definition and scope of O.R., Different types of O.R. Models, General methods for solving O.R. models, Main characterization and phase of O.R.

Replacement : Replacement of items that deteriorate with fail according to a probability law, Individual replacement policy, Group replacement policy.

Inventory Management : Inventory control, Techniques of inventory controls, Economic lot size problems with and without shortages, Technique of inventory control with uncertain demands, Inventory control with price breaks.

Sequential Theory : Introduction, Problems with n-jobs and two machines, n-jobs and three machines, n-jobs and m-machines, concept of job blocks.

Section IV (3 Questions)

General Stochastic Process, definition, classification and examples.

Markov chains, higher transition probabilities, limiting behavior (without proofs).

Poisson Process and related distribution. Generalized Birth death processes, Queueing systems, general concepts. Steady state solution of M/M/1, M/M/1/R, M/M/C, M/M/C/C models. Machine interference problem with single and multiple servers.

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1.	J.N. Kapur	Mathematical Modelling, New Age India Ltd.
2.	J.N. Kapur,	Mathematical Models in Biology and Medicine, Affiliated East-West Press (P) Ltd.
3.	S.M. Sinha	Mathematical Programming.
4.	Gass, S.I.	Linear Programming
5.	Taha, H.A	Operations Research: An Introduction, 6th edition.
6.	Kanti Swarup, P.K. Gupta and Manmohan	Operations Research
7.	Medhi, J.	Stochastic Processes
8.	Baily N.T.J.	Stochastic Processes

Paper XI : Advanced Discrete Mathematics

Option (ii) **Max. Marks : 80**
Time : 3 Hours

(Detailed syllabi to be framed later on).

Paper XI : Numerical Methods

Option (iii) **Max. Marks : 80**
Time : 3 Hours

(Detailed syllabi to be framed later on).

Paper XII: Database Management System and Visual Basic

Max. Marks : 80
Time : 3 Hours

Section I (2 Questions)

Terminologies of database, Drawbacks of conventional file systems, Data administrator (Role and functions), characteristics of databases. Data redundancy, data integrity, data independence. DBMS and its functions. Advantages and disadvantages of database.

Three levels of the architecture: External level, conceptual level and internal level, Mappings and schemas, Client/Server architecture, Distributed processing.

Section II (3 Questions)

Data model, Relational data model, Hierarchical data model, Network data model. Relational model, Basic structure, terminology. Normalization, First Normal Form, Second Normal Form, Third Normal Form, BCNF, Nonloss-Decomposition, Relational algebra and Relational Calculus, The SQL language.

Redundancy in hierarchical databases, Maintaining a hierarchical database, Retrieval of data.

Network schema, Maintaining a file in a Network database. Retrieval of data.

Section III (2 Questions)

Types of file organization: Heap organization, indexed organization, hashed organization, Data integrity and reliability, Management information system, Use of DBMS Package FOXPRO/ORACLE/MS-ACCESS.

Section IV (3 Questions)

Visual Basic : Introduction, Analyzing, Controls and Properties, Coding, Loops, Dialog Boxes, Additional Controls – Option Buttons, Frames, Check Boxes, Scroll Bars, Timer Control, Procedures and Functions, Using Debugging Windows, Database Programming, Crystal Reports. Simple Active X controls.

Note : Question paper will consist of four sections as indicated above. The candidate will be required to attempt 5 questions selecting at least one question from each section.

Books Recommended

1. C.J. Date, Sixth Ed., An Introduction to Database System, Addison-Wesley Publishing Co.
2. Ullman, Jeffery D., Principles of Database System, Computer Science Press.
3. James Martin, Principles of Database Management System, Prentice Hall of India Pvt. Ltd.
4. Desai, Bipin C., Introduction to Data base Systems, Galgotia Publ.
5. Whittington, R.P., Data Base Systems Engineering, Clavendon Press.
6. Kroenke, D.M., Database Processing : Fundamental

Design, Implementation, 2nd Edn. Galgotia Publ. Pvt. Ltd.

7. Wiederhold, Database Design, McGraw Hill Book Comp.
8. Reselman & Other, Using Visual Basic 6, Prentice Hall of India.
9. Donald & Oancea, Visual Basic 6 from Scratch, Prentice- Hall of India.
10. Days Maver, Teach Yourself More VB in 21 days, Techmedia.

Paper XIII : Object Oriented Programming with C++ and Software Engineering

Max. Marks : 80
Time :3 hours

Section I (2 Questions)

Basic concepts of Object-Oriented Programming (OOP). Advantages and applications of OOP. Object-oriented languages. Introduction to C++. Structure of a C++ program. Creating the source files. Compiling and linking.

C++ programming basics: Input/Output, Data types, Operators, Expressions, Control structures, Library functions.

Section II (3 Questions)

Functions in C++ : Passing arguments to and returning values from functions, Inline functions, Default arguments, Function overloading.

Classes and objects : Specifying and using class and object, Arrays within a class, Arrays of objects, Object as a function arguments, Friendly functions, Pointers to members.

Constructors and destructors. Operator overloading

and type conversions.

Inheritance : Derived class and their constructs, Overriding member functions, class hierarchies, Public and private inheritance levels.

Section III (3 Questions)

Polymorphism, Pointers to objects, this pointer, Pointers to derived classes, virtual functions.

Streams, stream classes, Unformatted Input/Output operations, Formatted console Input/Output operations, Managing output with manipulators.

Classes for file stream operations, Opening and Closing a file. File pointers and their manipulations, Random access. Error handling during file operations, Command-line arguments. Exceptional handling.

Section IV (2 Questions)

Software Engineering: Software crisis, Goals of software engineering, Software metrics and their importance, Software design and testing techniques, Case tools, Software Quality assurance.

Note : The question paper will consist of four sections as indicated above. The candidates will be required to attempt any 5 questions selecting atleast one question from each section.

Books Recommended :

1. I.S. Robert Lafore, Waite's Group Object Oriented Programming using C++, Galgotia Pub.
2. E. Balagrusamy, Object Oriented Programming with C++, 2nd Edition, Tata Mc Graw Hill Pub. Co.
3. Byron, S. Gottfried, Object Oriented Programming using C++, Schaum's Outline Series, Tata Mc Graw

Hill Pub. Co.

4. J.N. Barakaki, Object Oriented Programming using C++, Prentic Hall of India, 1996.
5. S. Roser Pressman, Software Engineering, A Practitioners Approach, Mc Graw Hill Book Co.
6. N.S. Gill, Software Engineering, Khanna Pub. Co., New Delhi.
7. K.K. Aggarwal and YOgesh Singh, Software Engineering, New Age Publishers, New Delhi.
8. M.L. Shooman, Software Engineering, Tata McGraw Hill.

Paper XIV : Practicals

Max. Marks : 80
Time : 4 Hours

The practical will be based on the Papers XII and XIII

i) Viva-voce and practical record : 30 marks

ii) Written practical work : 50 marks

The examiner shall set a question paper consisting of 4 questions and the examinees will be required to attempt any two. They will write the programs in Answer-books and will run the same on computers and they will take printouts of programs and output.