MAHATMA GANDHI UNIVERSITY

PRIYADARSINI HILLS

KOTTAYAM-686560

RESTRUCTURED SYLLABUS

FOR

POST-GRADUATE PROGRAM

IN

M.Sc APPLIED STATISTICS
WITH COMPUTER APPLICATIONS

MAHATMA GANDHI UNIVERSITY
KOTTAYAM

REGULATIONS FOR CREDIT AND SEMESTER SYSTEM

Duration

The duration of PG program shall be 4 semesters. The duration of each semester shall be 90 working days. Odd semesters extend from June to October and even semesters from December to April. There will be one month semester breaks each in November and May. A student may be permitted to complete the program, on valid reasons, with in a period of 8 continuous semesters from the date of commencement of the first semester of the programs.

Program Structure

The program includes two types of courses namely Program Core courses and Program Elective Courses. In the fourth semester the colleges can choose 4 electives that will suit the needs of students there, from the electives specified in the syllabus. There shall also be a Program Project with dissertation to be undertaken by all students. Every Program conducted under Credit Semester System shall be monitored by the College Council.

Viva Voce

Comprehensive Viva-voce shall be conducted at the end semester of the program and it shall cover questions from all courses in the program.

Project work

Project work shall be completed by working outside the regular teaching hours under the supervision of a teacher in the concerned department. There should be an internal assessment and external assessment for the project work. The external evaluation of the Project work is followed by presentation of work including dissertation and Viva-Voce.

Examinations

There shall be University examination at the end of each semester. Project evaluation and Viva -Voce shall be conducted at the end of the program only. Project evaluation and Viva-Voce shall be conducted by two external examiners and one internal examiner.

There shall be one end-semester examination of 3 hours duration in each lecture based course and practical course. The examinations for which computers are essential should be conducted in the computer lab supervised by an external examiner appointed by the university.

Evaluation and Grading

Evaluation: The evaluation scheme for each course shall contain two parts; (a) internal evaluation and (b) external evaluation. 25% weightage shall be given to internal evaluation and the remaining 75% to external evaluation

and the ratio and weightage between internal and external is 1:3. Both internal and external evaluation shall be carried out using direct grading system.

Internal evaluation: The internal evaluation shall be based on predetermined transparent system involving periodic written tests, assignments, seminars and attendance in respect of theory courses and based on written tests, lab skill/records/viva and attendance in respect of practical courses. The weightages assigned to various components for internal evaluation are as follows.

Components of Internal Evaluation

Component	**Weightage**
i) Assignment--------	1
ii) Seminar ----------	1
iii) Attendance --------	1
iv) Two Test papers—	2

Letter Grade	Performance	Grade Point(G)	Grade Range
A	Excellent	4	3.5 to 4.00
B	Very Good	3	2.5 to 3.49
C	Good	2	1.5 to 2.49
D	Average	1	0.5 to 1.49
E	Poor	0	0.0 to 0.49

Grades for Attendance

% of attendance	Grade
>90%	A
Between 85 and 90	B
Between 80 and below 85	C
Between 75 and below 80	D
< 75	E

To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal grade.

A separate minimum of C Grade for internal and external are required for a pass for a course. For a pass in a program a separate minimum grade C is required for all the courses and must score a minimum CGPA of 1.50 or an overall grade of C and above. Each course is evaluated by assigning a letter grade (A, B, C, D or E) to that course by the method of direct grading. The internal (weightage =1) and external (weightage =3) components of a course are separately graded and then combined to get the grade of the course after taking into account their weightages.

A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch. There will be no supplementary examination.

Assignments:

Every student shall submit one assignment as an internal component for every course. The Topic for the assignment shall be allotted within the 6th week of instruction.

Seminar Lectures

Every PG student shall deliver one seminar lecture as an internal component for every course. The seminar lecture is expected to train the students in self-study, collection of relevant matter from the books and Internet resources, editing, document writing, typing and presentation.

Class Tests

Every student shall undergo at least two class tests as an internal component for every course. The weighted average shall be taken for awarding the grade for class tests.

Attendance

The attendance of students for each course shall be another component of internal assessment. The minimum requirement of aggregate attendance during a semester for appearing the end semester examination shall be 75%. Condonation of shortage of attendance to a maximum of 10 days in a semester subject to a maximum of two times during the whole period of post graduate program may be granted by the University.

If a student represents his/her institution, University, State or Nation in Sports, NCC, NSS or Cultural or any other officially sponsored activities such as college union / university union activities, he/she shall be eligible to claim the attendance for the actual number of days participated subject to a maximum of 10 days in a Semester based on the specific recommendations of the Head of the Department and Principal of the College concerned. A student who does not satisfy the requirements of attendance shall not be permitted to take the end Semester examinations.

Mahatma Gandhi University, Kottayam, Kerala
Revised Syllabus of
M.Sc. Applied Statistics with Computer Applications Programme
Under Credit and Semester System (CSS) 2012

Course Code	Course Title	Credits	Teaching Hours	
	Semester-I (Total credits-20)			
AS1C01	*Distribution Theory	4	5	
AS1C02	*Analytical Tools for Statistics	4	5	
AS1C03	*Probability Theory	4	5	
AS1C04	*Mathematical Methods for Statistics	4	5	
AS1C05	Programming in C++		4	5
	Semester-II (Total credits-20)			
AS2C06	*Statistical Computational Techniques	4	5	
AS2C07	*Advanced Probability Theory	4	5	
AS2C08	*Statistical Estimation Theory	4	5	
AS2C09	*Stochastic Processes	4	5	
AS2C10	DBMS	4	5	
	Semester-III (Total credits-20)			
AS3C11	*Sampling Theory	4	5	
AS3C12	*Statistical Testing of Hypothesis	4	5	
AS3C13	*Design and Analysis of Experiments	4	5	
AS3C14	*Statistical Computing-1	4	5	
AS3C15	ASP	4	5	
	Semester-IV (Total credits-20)			
AS4C16	*Multivariate Analysis	3	5	
AS4E--	Elective-1	3	5	
AS4E--	Elective-2	3	5	
AS4E--	Elective-3	3	5	
AS4E--	Elective-4	3	5	
AS4D	*Dissertation/Project	3		
AS4V	*Viva-Voce	2		

Total credits for the programme-80 credits

List of Electives Offered

1. *Statistical Quality Control
2. *Econometric Methods
3. *Operations Research
4. *Population Dynamics
5. Java Programming
6. *Statistical Computing-2
7. Mathematical Economics
8. *Time Series Analysis

NB: * indicates that the paper is common with the M.Sc. Statistics Programme of M.G University.

SYLLABI OF COURSES OFFERED IN SEMESTER I

AS1 C01: DISTRIBUTION THEORY

UNIT I

Quick review of basic concepts in distribution theory:- generating functions and properties, pgf, mgf, cumulant generating function and characteristic functions, factorial moments and recurrence relation, Discrete Distributions:- Power series, Binomial, Geometric, Poisson, Negative binomial and Hyper geometric.

UNIT II

Continuous Distributions:- Rectangular, Exponential, Weibull, Beta, Gamma, Pareto, Normal, Lognormal, Cauchy, Laplace, Logistic.

UNIT III

Functions of Random variables and their distributions using transformations of variables techniques. Distributions of sums, products and ratios of independent r.v.s, compound, truncated and mixture distributions.

UNIT IV

Sampling distributions:- Chi-square, t and F distributions (central only) Order statistics and their distributions:- joint and marginal distributions of sample median, range and mid – range (Exponential, Uniform, Logistic)

Text Books:

1. Hogg R.V and Craig A.T (1989) Introduction to Mathematical Statistics, Macmillian publishing company.
2. Arnold B.C, Balakrishnan N and Nagaraja H.N (1992) A first Course in Order Statistics.
3. Gupta S.C and Kapoor V.K (2000) Fundamentals of Mathematical Statistics, S. Chand & Co, New Delhi.

Reference Books:

1. Johnson N.L, Kotz S and Kemp A.W (1992) Univariate discrete distributions, John Wiley.
2. Johnson N.L, Kotz S and Balakrishnan N (1991) Continuous Univariate distributions I & II, John Wiley.
3. Kotz S, Balakrishnan N and Johnson N.L (2000) Continuous Multivariate distributions, John Wiley and sons.
4. Rohatgi V.K (1988) An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
5. Mukhopadhaya P (1996) Mathematical Statistics, The New Central Book Agency.

AS1 C02: ANALYTICAL TOOLS FOR STATISTICS

UNIT I

Vector spaces, subspaces, linear independence of vectors, basis and dimension of a vector space, inner product and orthogonal vectors, Gram-Schmidt orthogonalization process, orthonormal basis, rank of a matrix, null space, partitioned matrices.

UNIT II

Linear equations, rank nullity theorem, characteristic roots and vectors, Cayley-Hamilton theorem, characteristic subspaces of a matrix, nature of characteristic roots of some special types of matrices, algebraic and geometric multiplicity of a characteristic root, generalized inverse, properties of g-inverse, Moore-Penrose inverse and its computations.

UNIT III

Quadratic forms, congruent transformations, congruence of symmetric matrices, canonical reduction and orthogonal reduction of real quadratic forms, nature of quadratic forms, simultaneous reduction of quadratic forms, similarity and spectral decomposition.

UNIT IV

Linear programming:- convex sets and associated theorems, introduction to linear programming problems (LPP), graphical solution, feasible, basic feasible and optimal basic feasible solutions to an LPP, theoretical development of simplex method, big-M method, two-phase simplex method, dual of linear programming, theorems of duality, dual-simplex method.

Text Books:

1. Shanti Narayan (1991) A text of book of matrices, S. Chand & Company, New Delhi
2. Graybill F. A. (1983) Matrices with applications in statistics, 2nd Ed. Wadsworth.
3. Biswas S. (1997) A text book of linear algebra, New age international.
4. Kanti Swaroop, Gupta P.K., et al, (1985) Operations Research, Sultan Chand & Sons.

Reference Books:

1. Rao C.R. (2002) Linear statistical inference and its applications, Second edition, Wiley Eastern.
2. Rao A.R. and Bhimasankaram P (1992) Linear Algebra, Tata McGraw Hill Publishing Company Ltd.
3. Sharma J.K. (2001) Operations Research: Theory and Applications, McMillan, New Delhi.

AS1 C03: PROBABILITY THEORY

UNIT I

Sequences and limit of sets, field, sigma field, measurable space, minimal sigma field, Borel field of R and of R^n, Random variables, vector random variables and limit of random variables.

UNIT II

Probability space, monotone and continuity property of probability measure , independence of finite number and sequence of events, Borel - Cantelli Lemma, Borel 0-1 law, conditional probability and Baye's Theorem for a finite number of events.

UNIT III

Distribution function:- properties - decomposition theorem, correspondence theorem (without proof), distribution function of vector random variables, mathematical expectation and properties, moments, basic, Markov, Jensen, Cr-inequalities.

UNIT IV

Convergence of random variables, convergence in probability, almost sure convergence, convergence in distribution, and convergence in r^{th} mean, properties and relations among them, independence of finite and sequence of random variables, weak and complete convergence of distributions, Helly-Bray lemma (statement only), Helly-Bray theorem (statement only).

Reference Books:

1. Bhat B.R (1981) Modern Probability theory, Wiley Eastern LTD, New Delhi.
2. Rohatgi V.K (1990) An introduction to probability theory and Mathematical statistics, Wiley Eastern ltd.
3. Billingsley P (1985) Probability and Measure, Wiley Eastern ltd.
4. Ash R.B (1972) Real Analysis and Probability, Academic press.
5. Laha R.G and Rohatgi V.K (1979) Probability theory, Van Nostrand.
6. Loeve M (1963) Probability Theory, Van Nostrand, Princeton.

AS1 C04: MATHEMATICAL METHODS FOR STATISTICS

UNIT I

Sequences and series, convergence, continuity, uniform continuity, differentiability. Functions of several variables: maxima and minima, Method of Lagrangian multipliers, Riemann integral, Laplace transform and its applications to differential equations.

UNIT II

Measurable space and sets, Measure and measure space, finite and σ finite measures. Counting measure, Lebesgue measure, Lebesgue- stieltjes measure and general measure, Measurable functions.

UNIT III

Lebesgue integral. General definition of integral of a measurable function and its elementary properties. Fatou's lemma. monotone convergence theorem, Lebesgue dominated convergence theorem.

UNIT IV

Algebra of complex numbers, Analytic functions, Cauchy-Riemann equations, contour integral, Cauchy's theorem (without proof), Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Zeroes of a function, singular point, different types of singularities, residues at a pole.

Text Books:

1. Apostol T.M. (1996) Mathematical Analysis, second Edition, Narosa Publishing House, New Delhi.
2. Churchill R.V (1975) Complex variables and applications, McGraw Hill.

Reference Books:

1. Andre's I. Khuri (1993) Advanced Calculus with applications in statistics. Wiley & sons.
2. Malik S.C & Arora S (2006) Mathematical analysis, second edition, New age international.
3. Pandey H.D, Goyal J. K & Gupta K.P (2003) Complex variables and integral transforms Pragathi Prakashan, Meerut.

AS1C05 PROGRAMMING IN C++

Unit I

Object Oriented Approach: Principles of Object Oriented Programming, Benefits of Object Oriented Programming. Application of Object Oriented Programming, Beginning with C++ : Basic program construction ,Preprocessor directives , Input & output statements ,Variables, Basic Data types, User Data types. Operators-Arithmetic operators, Assignment Operators, Logical operators, Conditional operators, Manipulators, Type conversion Control Statements, Looping Statements, Decision Making Statements.

Functions in C++. Function declaration, definition and calling a function, Passing arguments to functions, Returning values from functions, Overloaded functions, Inline functions, Friend and Virtual functions

Unit II:

Classes and Objects :Structure of a Class, Defining a Class,C++ Objects, Objects as function arguments, Returning objects from functions.Arrays. Defining arrays, Initializing arrays, Accessing array elements, Multidimensional Arrays, Passing arrays to functions, Array of objects, Array of Strings.Constructors and Destructors ,Parameterized constructors, Multiple constructors in a class, Constructors with Default Arguments, Dynamic Constructors, Copy Constructor, Destructors.Operator Overloading: Defining Operator Overloading,Overloading Unary and binary operators as member and friend functions,.Manipulation of String using operators. Inheritance : Derived and Base Class, Defining Derived Classes , Levels of Inheritance -Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance Public and Private Inheritance , Virtual base classes Abstract Classes , Constructors in Derived Classes , Nesting of Classes

Unit III

Pointers: Address and Pointers, Pointers and Arrays ,Pointer and Functions , Pointers and Strings, Memory management , Pointers to Objects , this pointer ,Pointers to pointers , Virtual Functions, Friend functions, Static functions, Polymorphism. Managing Console I/O Operations, C++ Streams , C++ Stream classes, Unformatted I/O operations , Formatted I/O operations , Managing Output with manipulators.

Unit IV

Working with Files : File Stream classes , Opening and closing a file, File Modes, File Pointers and their manipulations, Sequential Input and Output Operations , Error handling during file operations, Command line arguments, Overloading the extraction and insertion operators , Exception Handling.

Reference:

1.Object Oriented programming in Turbo C++ - Robert Lafore (Galgotia Publications)
2.Object Oriented programming with C++ - E Balaguruswamy (Tata McGraw-Hill Limited)

SYLLABI OF COURSES OFFERED IN SEMESTER II
AS2 C06: STATISTICAL COMPUTATIONAL TECHNIQUES

UNIT I

Solution to algebraic and transcendental equations:- Bisection Method, Iteration method, Regula -falsi method, Newton-Raphson method. Solution to Simultaneous linear equations:- Gauss elimination method, Gauss-Jordan methods, Jacobi's method, Gauss-Seidel method, solution to non-linear equations – Newton Raphson method.

UNIT II

Interpolation - Newtons forward interpolation formula, Lagrange's interpolation formula, Numerical integration- General Quadrature formula, Newton-Cotes formula, Trapeizoidal, Simpson's (1/3), Simpson's (3/8) and Weddle's formula, Romberg integration and errors in numerical integration formulas.

UNIT III

Monte Carlo methods, Random Number Generation- Basic principles of Random number generation, inversion method, accept-reject method, Random number generation from Uniform, Exponential, Cauchy, Normal, Beta, Gamma densities, Random number generation from Binomial, Poisson and Geometric.

UNIT IV

Introduction to statistical software R, Data objects in R, Manipulating vectors, matrices, lists, importing of files, data frame, and computations of descriptive statistics measures. R-Graphics- Histogram, Box-plot, Stem and leaf plot, Scatter plot, Plot options; Multiple plots in a single graphic window, frequency table, Plotting of probability distributions and sampling distributions, Controlling Loops- For, repeat, while, if , if else etc. Implementation of numerical methods in unit I, unit II and Unit III using R.

Reference Books:

1. Sastry S.S. (1998) Introductory methods of numerical analysis. Third edition, Printice Hall, New Delhi.
2. Mohanan J.F (2001) Numerical methods of statistics, Cambridge University Press.
3. Srimanta Pal (2009) Numerical Methods- Principles, Analysis and Algorithms. Oxford University Press.
4. Alain F. Zuur, Elena N. Ieno, and Erik Meesters (2009) A Beginner's Guide to R, Springer, ISBN: 978-0-387-93836-3.
5. Michael J. Crawley (2005) Statistics: An Introduction using R, Wiley, ISBN 0-470-02297-3.
6. Phil Spector (2008) Data Manipulation with R, Springer, New York, ISBN 978-0-387-74730-9.
7. Maria L. Rizzo (2008) Statistical computing with R, Chapman & Hall/CRC, Boca Raton, ISBN 1-584-88545-9.
8. Fishman G.S. (1996) Monte Carlo: Concepts, Algorithms, and Applications (Springer).
9. Purohit S.G., Gore S.D. and Deshmukh S.R. (2008) Statistics Using R. Narosa Publishing House, New Delhi.

AS2 C07: ADVANCED PROBABILITY THEORY

UNIT I

Signed measure, Hahn and Jordan Decomposition theorems. Statement and applications of Radon – Nikodym Theorem (without proof), Lebesgue decomposition, Fubini's theorem (without proof), Probability space induced by a random variable, by a random vector, conditional expectation of a random variable, martingales, submartingles, super martingales, simple Properties of Martingales.

UNIT II

Characteristic function of a random variable, properties, uniform continuity and non-negative definiteness, statement of Bochner's Theorem, continuity and inversion theorems of characteristic functions, convex combinations of characteristic functions and distribution functions, characteristic function of a vector random variable.

UNIT III

Law of Large numbers, Weak Law of Large numbers of Bernoulli, Chebychev, Poisson and Khinchine, Kolmogrov strong law of large numbers for independent random variables- for i.i.d random variables, necessary and sufficient condition for weak law of large numbers.

UNIT IV

Central limit theorem, Demoivre-Laplace CLT, Lindberg -Levy and Liaponov CLT, Lindberg- Feller CLT (Without proof), domain of attraction and stable distributions.

Reference Books:

1. Bhat B.R (1981) Modern Probability theory, Wiley Eastern Ltd, New Delhi.
2. Rohatgi V.K (1990) An introduction to probability theory and Mathematical statistics, Wiley Eastern ltd.
3. Billingsley P (1985) Probability and Measure, Wiley Eastern Ltd.
4. Ash R.B (1972) Real Analysis and Probability, Academic press.
5. Laha R.G and Rohatgi V.K (1979) Probability theory, Van Nostrand.
6. Luckas E (1970) Characteristic functions, 2nd Edition, Hofna NewYork.
7. Parthasarathy K.R (1973) Introduction to Probability and Measure, Mac Millian.

AS2 C08: STATISTICAL ESTIMATION THEORY

UNIT I

Criteria for estimators - unbiasedness, consistency and efficiency, minimum variance, Fisher information, Cramer – Rao inequality, Bhattacharyya's bounds.

UNIT II

Sufficiency, completeness, bounded completeness, Fisher-Neymann factorization theorem, minimal sufficiency, exponential families, Rao- Black well theorem, Lehmann – Scheffe theorem, ancillary statistics, Basu's theorem.

UNIT III

Methods of estimation: method of moments, method of maximum likelihood & their properties, Fisher's scoring method, method of minimum chi-square and method of modified minimum chi-square, confidence intervals, shortest confidence intervals.

UNIT IV

Elements of decision theory, statistical decision problem, loss and risk functions, decision rule, estimation and testing as particular cases, prior and posterior distributions, Bayes estimator, admissible decision rules, non-randomized and randomized decision rules, bootstrap and Jackknife techniques (basic concepts only).

Reference Books:

1. Lehmann E.L. (1983) Theory of point estimation – Wiley, New York.
2. Rohatgi V.K. (1988) An introduction to probability theory and mathematical statistics, Wiley Eastern.
3. Hogg R. V. and Craig A. T. (1989) Introduction to Mathematical Statistics, Macmillan Publishing Company.
4. Kale B. K. (1999) A First Course on Parametric Inference, Narosa Publishing House.
5. Lindgren B.W (1976) Statistical Decision Theory (3rd Edition), Collier Macmillian, New York.
6. Rao C.R (1974) Linear Statistical Inference and its Applications, John Wiley, New York.

AS2 C09: STOCHASTIC PROCESSES

UNIT I

Introduction to stochastic processes:- classification of stochastic processes according to state space and time space, wide sense and strict sense stationary processes, processes with stationary independent increments, Markov process, Markov chains-transition probability matrices, Chapman-Kolmogorov equation, first passage probabilities, generating functions, classification of states, criteria for recurrent and transient states, mean recurrence time, mean ergodic theorem, the basic limit theorem of Markov chains (statement only), reducible and irreducible Markov chains, stationary distributions, limiting probabilities and absorption probabilities.

UNIT II

Random walk, gambler's ruin problem; Galton-Watson branching process, generating function relations, mean and variance functions, extinction probabilities, criteria for extinction.

UNIT III

Continuous time Markov chains, Poisson processes, pure birth processes and the Yule processes, birth and death processes, Kolmogorov forward and backward differential equations, linear growth process with immigration, steady-state solutions of Markovian queuing models--M/M/1, M/M/1 with limited waiting space, M/M/s, M/M/s with limited waiting space and M/G/1.

UNIT IV

Renewal processes– concepts, examples, Poisson process viewed as a renewal process, renewal equation, elementary renewal theorem, asymptotic expansion of renewal function, central limit theorem for renewals, key renewal theorem (statement only), delayed renewal processes.

Text Books:

1. Ross S.M. (2007) Introduction to Probability Models, Ninth edition, Academic Press.
2. Bhat B.R. (2002) Stochastic Processes, second edition, New Age Publication.

Reference Books:

1. Feller W. (1968) Introduction to Probability Theory and its Applications, Vols. I & II, John Wiley, New York.

2. Karlin S. and Taylor H.M. (1975) A First Course in Stochastic Processes, Second edition, Academic Press, New-York.

3. Cinlar E. (1975) Introduction to Stochastic Processes, Prentice Hall, New Jersey.
4. Medhi J. (1996) Stochastic Processes. Second Editions, Wiley Eastern, New-Delhi.

5. Basu A.K. (2003) Introduction to Stochastic Processes, Narosa, New-Delhi.

6. Bhat U.N. and Miller G. (2003) Elements of Applied Stochastic Processes. (Third edition), John Wiley, New York.

AS2C10 : DBMS

Unit I

Introduction : Purpose of dB Systems . View of Data , Data Models , Database Language , Transaction Management , Storage Management , Database Administration , Database Users. E-R Model : Basic Concepts, Design Issues , Mapping Constraints , Keys , E-R Diagrams, Weak Entity Sets , Extended ER Features , Design of an E-R dB Schema , Reduction of an E-R Schema to Tables, Relational Model : Structure of Relational dB , Relational Algebra , Tuple Relational Calculus , Domain Relational Calculus, Extended Relational- Algebra ,Operation ,Modification of the dB.

Unit II

SQL : Basic Structure , Set Operations , Aggregate Functions , Null Values , Nested Sub queries , Derived Relations , Views , Modification of the dB , Joined Relations , Data Definition Language. Integrity constraints , Domain Constraints , Referential Integrity , Assertion , Triggers, Functional Dependencies , Relational dB Design, Decomposition , Normalization 1N, 2N, 3N , Domain- key Normal Form .

Unit III

Object Oriented dB ,, New dB Applications , Object Oriented Data Model , Object Oriented Languages , Persistent Programming Language ,Persistent C++ Systems , Nested Relations , Complex Types & Object Orientation , Querying with Complex Types , Creation of Complex Values & Objects , Comparison of Object-Oriented & Object- Relational dB.

Unit IV

Parallel dB Introduction , I/O Parallelism , Intraquery Parallelism , Distributed dB , Distributed data storage , Network Transparency , Distributed Query Processing , Distributed Transaction Model , Decision- Support System , Data Analysis , Data Mining , Data Warehousing , Multimedia dB.

Text Book:

1.Database System Concepts Author: Abraham Silberschatz, Henry F.Korth, S.Sudarshan. (Mc GrawHill Publications)

SYLLABI OF COURSES OFFERED IN SEMESTER III

AS3 C11: SAMPLING THEORY

UNIT I

Census and sampling methods, probability sampling and non-probability sampling, principal steps in sample surveys, sampling errors and non-sampling errors, bias, variance and mean square error of an estimator, simple random sampling with and without replacement, estimation of the population mean, total and proportions, properties of the estimators, variance and standard error of the estimators, confidence intervals, determination of the sample size.

UNIT II

Stratified random sampling, estimation of the population mean, total and proportion, properties of estimators, various methods of allocation of a sample, comparison of the precisions of estimators under proportional allocation, optimum allocation and srs. Systematic sampling – Linear and Circular, estimation of the mean and its variance. comparison of systematic sampling, srs and stratified random sampling for a population with a linear trend.

UNIT III

Ratio method of estimation, estimation of the population ratio, mean and total, first order approximate expression for bias, mse of ratio estimates, comparison with srs estimation. Unbiased ratio type estimators- Hartly- Ross estimator, regression method of estimation, first order approximate expression for bias and mse of linear regression estimators, large sample comparison with mean per unit estimator and ratio estimators, Cluster sampling, single stage cluster sampling with equal and unequal cluster sizes, estimation of the population mean and its standard error. Two- stage cluster sampling with equal and unequal cluster sizes, estimation of the population mean and its standard error.

UNIT IV

Unequal probability sampling, PPS sampling with and without replacement, cumulative total method, Lahiris method, Midzuno-Zen method, estimation of the population total and its estimated variance under PPS wr sampling, ordered and unordered estimators of the population total under PPS wor, Horwitz – Thomson estimator and its estimated S. E, Des-Raj's ordered estimator, Murthy's unordered estimator (properties of these estimators for n=2 only)

Text Books:

1. Cochran W. G. (1999) Sampling Techniques, 3rd edition, John Wiley and Sons.
2. Mukhopadyay P. (2009) Theory and Methods of Survey Sampling, 2nd edition, PHL, New Delhi.

Reference Books:

1. Singh D. and Choudhary F. S. (1986) Theory and Analysis of Sample Survey Designs, Wiley Eastern Ltd.
2. Des Raj (1967) Sampling Theory, Tata McGraw Hill, New Delhi.
3. Sampath S. C. (2001) Sampling Theory and Methods, Alpha Science International Ltd., India.

AS3 C12: STATISTICAL TESTING OF HYPOTHESES

UNIT I

Basic concepts in testing of hypothesis, randomized tests, Neymann- Pearson lemma and most powerful tests, monotone likelihood ratio (MLR) property, uniformily most powerful (UMP) tests, construction of uniformly most accurate (UMA) confidence intervals using UMP tests, uniformly most powerful unbiased (UMPU) tests, construction of uniformly most accurate unbiased (UMAU) confidence intervals using UMPU tests, Locally most powerful (LMP) and locally most powerful unbiased (LMPU) tests.

UNIT II

Similar regions tests, Neymann structure tests, likelihood ratio (LR) tests and their properties, LR tests for testing equality of mean and variance of two normal populations.

UNIT III

Sequential probability ratio tests (SPRT), Properties of SPRT, Construction of sequential probability ratio tests, Wald's fundamental identity, Operating characteristic (OC) function and Average sample number (ASN) functions.

UNIT IV

Non-parametric tests-- sign test, signed rank test, Chi-square tests, Kolmogorov-Smirnov one sample and two samples tests, median test, Mann- Whiteny U-test, Wilcoxon test, test for randomness, Wald–Wolfowitz run test for equality of distributions, Kruskall–Wallis one-way analysis of variance, Friedman's two-way analysis of variance.

Text Books:

1. Rohatgi V.K. (1976) An Introduction to Probability Theory and Mathematical Statistics, John Wiley & Sons, New York.
2. Manojkumar Srivastava and Namita Srivstava (2009) Statistical Inference: Testing of Hypothesis, Eastern Economy Edition, PHI Learning Pvt. Ltd., New Delhi.

References Books:

1. Gibbons J.K. (1971) Non-Parametric Statistical Inference, McGraw Hill.
2. Casella G. and Berger R.L. (2002) Statistical Inference, Second Edition Duxbury, Australia.
3. Lehman E.L. (1998) Testing of Statistical Hypothesis. John Wiley, New York.
4. Wald A. (1947) Sequential Analysis, Wiley, Doves, New York.
5. Dudewicz E.J. and Mishra S.N. (1988) Modern Mathematical Statistics, John Wiley & Sons, New York.
6. Siegel S. and Castellan Jr. N. J. (1988) Non-parametric Statistics for the Behavioral Sciences, McGraw Hill, New York.
7. Rao C.R. (1973) Linear Statistical Inference and its Applications, Wiley.

AS3 C13: DESIGN AND ANALYSIS OF EXPERIMENTS

UNIT I

Linear estimation: standard Gauss Markoff set up, estimability of parameters, method of least squares, best linear unbiased Estimators, Gauss – Mark off Theorem, tests of linear hypotheses.

UNIT II

Planning of experiments, Basic principles of experimental design, uniformity trails, analysis of variance, one-way, two-way and three-way classification models, completely randomized design (CRD), randomized block design (RBD) latin square design (LSD) and Graeco-latin square designs, Analysis of covariance (ANCOVA), ANCOVA with one concomitant variable in CRD and RBD.

UNIT III

Incomplete block design; balanced incomplete block design (BIBD); incidence Matrix, parametric relation; intrablock analysis of BIBD, basic ideas of partially balanced incomplete block design (PBIBD).

UNIT IV

Factorial experiments, 2^n and 3^n factorial experiments, analysis of 2^2, 2^3 and 3^2 factorial experiments, Yates procedure, confounding in factorial experiments, basic ideas of response surface designs.

Reference Books:

1. Aloke Dey (1986) Theory of Block Designs, Wiley Eastern, New Delhi.

2. DAS M.N. and GIRI N.C. (1994) Design and analysis of experiments, Wiley Eastern Ltd.

3. Joshi D.D. (1987) Linear estimation and Design of Experiments, Wiley Eastern.

4. Montgomery C.D. (1976) Design and Analysis of Experiments John Wiley, New York.

5. Chakrabarti M.C. (1962) Mathematics of Design and Analysis of Experiments, Asia publishing House, Bombay.

AS3 C14: STATISTICAL COMPUTING

Applications of topics covered in the following papers

1. AS3 C11:Sampling Theory
2. AS3 C12: Statistical Testing of Hypotheses
3. AS3 C13: Design and Analysis of Experiments
4. AS2 C08: Statistical Estimation Theory

Here 6 numerical questions each having a weight of 10 are to be asked. The student is expected to answer 3 questions. At least one question from each of the above papers must be asked. Use of packages R and MS-Excel is allowed for answering the questions in this paper. Examination of 3 hour duration must be conducted in the computer lab with the assistance of an external examiner appointed by the University.

AS3C15 ACTIVE SERVER PAGES (ASP)

Unit I

Internet Basics: Communicating on the Internet, Internet Domains, Web Browser Software, Different Protocols of Internet (TCP/IP, HTTP, FTP, TELNET, SMTP…), IP Address, HTML – HTML Tags, Lists, Adding Graphics to HTML Documents, Tables, Hyperlinks, Frames, Image Maps, Forms. DHTML – Cascading Style Sheets, Font Attributes, Color and Background Attributes, Text Attributes, Border Attributes, Margin Related Attributes, List Attributes, Class, Using <SPAN>…</SPAN> tag, External Style Sheets, Using <DIV>…</DIV> tag, Using <LAYER>…</LAYER>tag. VBScript: Data Types, Variables, Operators, Decision Control Statements, Loop, Control Statements, Functions, Arrays, Dialog Boxes.

Unit II

JavaScript- The Advantages of JavaScript, Writing JavaScript into HTML, Basic Programming Techniques, Data Types, Variables, Operators, Decision Control Statements, Loop Control Statements, Functions, Arrays, Dialog Boxes, JavaScript Document Object Model, The Window Object, Location Object, History Object, The Document Object, Link and Anchor Objects, Image and Area Objects, The Form Objects
Text Related Objects: Text Object, Password Object, Text area Object, Hidden Object
Button Objects: Button Object, Submit Object, Reset Object, Checkbox Object, Radio Objects, Select Object, String Object, Date Object.

Unit III

Active Server Pages- Understanding the Client-Server Model, Understanding Web Server Software, the ASP Process. Response Object: Sending HTML to the Browser, Buffering ASP pages, Sending the user another page, Writing Cookies, Caching your ASP Pages. Request Object: Retrieving the results of a form, Accessing the HTTP headers, Accessing the Environment Variables, Reading Cookies. Session Object: Using Session Variables, Application Object: Using Application Variables. Creating a Global.asa file: Common ASP Components, Ad Rotator Component, Content Linker Component, Reading and Writing Files on the Web Server: Server-Side Includes, Accessing Files and Folders, Determining the properties of Files and Folders on the Web Server, Reading Files, Writing Files to the server, Appending Files.

Unit IV

Using Databases ; What are Relational Databases? Databases and ASP, Communicating with a database Using ActiveX Data Objects (ADO), The Connection Object, Using System DSN, Using a DSN – less Connection, Reading Data from a Database, The Recordset Object, Reading and Displaying the Contents of a Database Table.

Text Books

1.Active Server Pages 3.0 in 21 Days –Scottmichell
2.HTML Black Book –Steven Holzner
3. Java Script Bible- Daany Goodman
4.VB Script Interactive Course- Noel Jerke.

SYLLABI OF COURSES OFFERED IN SEMESTER IV

AS4 C16: MULTIVARIATE ANALYSIS

Unit-I

Multivariate Normal Distribution – Definition and properties, conditional distribution, marginal distribution. Independence of a linear form and quadratic form, independence of two quadratic forms, distribution of quadratic form of a multivariate vector. Partial and multiple correlation coefficients, partial regression coefficients.

Unit-II

Estimation of mean vector and covariance vector – Maximum likelihood estimation of the mean vector and dispersion matrix. The distribution of sample mean vector, inference concerning the mean vector when the dispersion matrix is known for single and two populations. Distribution of simple, partial and multiple (null-case only) correlation coefficients; canonical correlation. Wishart distribution – properties – generalized variance.

Unit-III

Testing Problems – Mahalanobis D^2 and Hotelling's T^2 Statistics, Likelihood ratio tests Testing the equality of mean vector, equality of dispersion matrices, testing the independence of sub vectors, sphericity test.

Unit-IV

The problem of classification – classification of one of two multivariate normal population when the parameters are known and unknown. Extension of this to several multivariate normal populations. Population principal components, canonical variables and canonical correlations, Factor analysis.

Text Books:

1. Anderson T. W. (1984) An Introduction to Multivariate Statistical Analysis (2^{nd} ed.) John Wiley.
2. Johnson R.A. and Wichern D.W. (1990) Applied Multivatiate Statistical Analysis. Pearson education.

Reference Books:

1. Rencher,A. C. (1995) Methods of Multivariate Analysis. John Wiley.
2. Seber G. F. (1983) Multivariate Observations, John Wiley.
3. Rao C. R. (1973) Linear Statistical Inference and Its Applications (2^{nd} Ed.), Wiley Eastern Ltd.

AS4 E01: STATISTICAL QUALITY CONTROL

UNIT I

Statistical process control, theory of control charts, Shewhart control charts for variables-$\bar{x}$, R, s charts, attribute control charts - p, np, c, u charts, modified control charts.

UNIT II

O.C and ARL curves of control charts, moving average control charts, EWMA charts, CUSUM charts, process capability analysis, process capability indices – C_p and C_{pk}.

UNIT III

Acceptance sampling for attributes, single sampling, double sampling, multiple sampling and sequential sampling plans, rectifying inspection plans, measuring performance of the sampling plans- OC, AOQ, ASN, ATI curves.

UNIT IV

Acceptance sampling plans by variables, designing a variable sampling plan with a specified OC curve, sampling plan for a single specification limit with known and unknown variance.

Text Books:

1. Montgomery D. C. (2005) Introduction to Statistical Quality control, 5th edition, Wiley.
2. Grant E. L. and Leavenworth R. S. (1980) Statistical Quality control, McGraw Hill.

Reference books:

1. Duncan A. J. (1980) Quality control and Industrial Statistics, Irwin Homewood.
2. Schilling E. G. (1982) Acceptance Sampling in Quality Control, Marcel Decker.
3. Ott E.R. (1975) Process Quality Control, McGraw Hill.
4. Mittag H. J. and Rinne, H. (1993) Statistical Methods for Quality Assurance, Chapman and Hall.
5. Chin-knei Cho (1987) Quality Programming, John Wiley.

AS4 E02: ECONOMETRIC METHODS

UNIT I

Demand and supply functions, elasticity of demand, equilibrium of market, production functions- homogeneous functions, elasticity of production, input- output analysis, simple linear regression models.

UNIT II

Multiple linear regression models, estimation of the model parameters, tests concerning the parameters, confidence intervals, prediction, heteroscedasticity, tests, consequences, Multicollinearity- consequences, Farrar-Glauber test, remedial measures.

UNIT III

Aitken's generalized least square method, tests for auto correlation, consequences, and estimation procedures, stochastic regressors, errors in variables, use of Dummy variables in regression, polynomial regression models, logistic regression, step-wise regression.

UNIT IV

Simultaneous equation models, instrumental variables, recursive models, distributed-lag models identification problems, rank and order condition, methods of estimation-indirect least squares, least variance ratio and two-stage least squares, FIML-methods.

References Books:

1. Johnston J. (1984) Econometric Methods (Third edition), McGraw Hill, New York.

2. Montgomery D.C., Peck E.A. and Vining G.G. (2007) Introduction to Linear Regression Analysis, John Wiley, India.

3. Gujarati D (1979) Basic Econometrics, McGraw Hill.

4. Koutsoyiannis A (1979) Theory of Econometrics, Macmillian Press.

5. Apte P.G. (1990) Text book of Econometrics, Tata Me Graw Hill.

6. Theil H. (1982) Introduction to the Theory and Practice of Econometrics, John Wiley.

AS4 E03: OPERATIONS RESEARCH

UNIT I

Transportation problems, assignment problems, Sequencing problem, traveling salesmen problems, network analysis, GANTT, CPM, PERT.

UNIT II

Inventory models, deterministic inventory models, EOQ models with and without shortages, multi-item deterministic models with one linear constraint, EOQ problem with price breaks, probabilistic inventory models single period stochastic models without set up cost, general single period models.

UNIT III

Characteristics of dynamic programming and developing optimal decision policy using Bellman's principle of optimality, dynamic programming under certainty, single additive constraint-additives separable returns, single multiplicative constraint-additives separable return, single additive constraint multiplicatively separable return, dynamic programming approach for solving LPP, NLPP, quadratic programming, Kuhn -Tucker conditions, Wolfe's modified simplex method and Beale's method.

UNIT IV

Theory of games, two person zero-sum games, fundamental theorem of matrix games, dominance property, graphical method of solution of 2xn and mx2 games, Rectangular games as LPP.

Reference Books:

1. Ravindran A, Philips D.T and Soleberg, Operations Research – Principles and Practice, John Wiley and Sons.
2. J K Sharma Operations research – Theory and Applications Macmillan.
3. Frederick S Hiller and Gerala Jlieberman, Introduction to Operations Research Tata Mcgraw Hill.
4. Kanti Swarup, Gupta, Manmohan (2004) 10^{th} edition, Operations Research – Principles and Practice.
5. Thaha H A, Operations Research – An Introduction, Prentice Hall.
6. Mittal K.V (1983) Optimization methods in OR system analysis, Wiley Eastern.

AS4 E04: POPULATION DYNAMICS

UNIT I

Sources of mortality data-mortality measures-ratios and proportions, crude mortality rates, specific rates- standardization of mortality rates, direct and indirect methods, gradation of mortality data, fitting Gompertz and Makeham curves.

UNIT II

Life tables-complete life table-relation between life table functions, abridged life table-relation between abridged life table functions, construction of life tables, Greville's formula, Reed and Merrell's formula- sampling distribution of life table functions, multivariate pgf –estimation of survival probability by method of MLE.

UNIT III

Fertility models, fertility indices-relation between CBR,GFR,TFR and NRR stochastic models on fertility and human reproductive process, dandekar's modified binomial and Poisson models, Brass, Singh models-models for waiting time distributions, Sheps and Perrin model.

UNIT IV

Population growth indices, logistic model, fitting logistic, other growth models, Lotka's stable population, analysis, quasi stable population, effect of declining mortality and fertility on age structure, population projections, component method-Leslie matrix technique, properties of time independent Leslie matrix-models under random environment

Text Books:

1. Biswas S (1988) Stochastics processes in Demography and applications, Wiley Eastern.
2. Biswas S (2007) Applied Stochastic Processes-A Biostatistical and Population Oriented Approach (2^{nd} edn), New Central Book Agency.

Reference Books:

1. Keyfitz N (1977) Applied Mathematical Demography A Wiley Interscience publication.
2. Pollard J.H (1975) Mathematical Models for the growth of Human population, Cambridge University Press.
3. Ramkumar R (1986) Technical Demography, Wiley Eastern.
4. Srinivasan K (1970) Basic Demographic Techniques and Applications.

AS4 E05: JAVA PROGRAMMING.

Unit I
Introduction to internet, Object Oriented Programming Concepts, Java History, Introduction to Java, Java Application, Data types, operators & control statements, Class fundamentals, Constructors, Overloading constructors, Methods, Method overloading, Static, finalize, final , Garbage collection, Interface, Inheritance, Method overriding, Abstract classes.

Unit II
Packages, Exception handling, Multithreaded programming, Exploring java packages, Java.IO package, Java Applet, Java String class, Java.Util Package, Java.AWT, Event handling, Java swing, JDBC

Unit III
Servers,Understanding the Client-Server Model , Types of servers ,Tomcat Server5.5 Servlet Basics ,Servlet life cycle

Unit IV
Sending HTML information ,Retrieving information ,Generic Servlet ,Database connectivity in Servlet , Http Servlet , Session Tracking Servlet Filtering.

References:

1.Java Complete Reference
2.Java Black Book.

AS4 E06: STATISTICAL COMPUTING-2

Applications of topics covered in the following papers

1. ASC16: Multivariate Analysis
2. AS E01: Statistical Quality Control
3. AS E 02: Econometric Methods
4. AS E 03: Operations Research

Here 6 numerical questions each having a weight of 10 are to be asked. The student is expected to answer 3 questions. At least one question from each of the above papers must be asked. Use of packages R and MS-Excel is allowed for answering the questions in this paper. Examination of 3 hour duration must be conducted in the computer lab with the assistance of an external examiner appointed by the University.

AS4 E07: MATHEMATICAL ECONOMICS

Module1
Theory and analysis of consumer behavior-introductory, demand curve- marginal rate of substitution-indifference curve approach-consumer's equilibrium

Module 2
The production function - producer's equilibrium- Elasticity, Euler's theorem, Cobb Douglas production function - the CES production function

Module 3
Input output analysis - meaning of input output-main features of analysis-Assumptions-Leontief's static and dynamic model, limitations - importance and application of the analysis

Module4
Simple linear model, General linear model, estimation of parameters, classical least squares, generalized least square, multi collinearity, serial correlation and hetroscedasticity

Module 5
Simultaneous linear equation model, identification problems, rank and order conditions, single equations and simultaneous equations , methods of estimation-Indirect least squares and two stage least square methods.

Reference:-
1.S.P.SINGH & others –Econometrics & Mathematical Economics. S.Chand&co
2.ALLEN- Mathematical Economics 2nd Edn. Mac Millian
3. DAMODAR N GUJARARHI (1995): Basic Econometrics 3rd Edn. Mc Graw Hill.
4 JOHNSTON J. (1984): Economic Methods 3rd Edn. Mc Graw Hill.

AS4 E08: TIME SERIES ANALYSIS

UNIT I

Time series, components of time series, additive and multiplicative models, determination of trend, analysis of seasonal fluctuations, test for trend and seasonality, exponential and moving average smoothing, holt-winter smoothing, forecasting based on smoothing.

UNIT II

Time series as a discrete parameter stochastic process, auto covariance and auto correlation functions and their properties, stationary processes, test for stationarity, unit root test, stationary processes in the frequency domain, spectral analysis of time series.

UNIT III

Detailed study of the stationary processes: moving average (MA), autoregressive (AR), autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models.

UNIT IV

Estimation of ARMA models, maximum likelihood method (the likelihood function for a Gaussian AR(1) and a Gaussian MA(1)) and Least squares, Yule-Walker estimation for AR Processes, choice of AR and MA periods, forecasting, residual analysis and diagnostic checking.

Text Books:

1. Chatfield C. (2004) The Analysis of Time Series - An Introduction (Sixth edition), Chapman and Hall.
2. Abraham B. and Ledolter J.C. (1983) Statistical Methods for Forecasting, Wiley.

Reference Books:

1. Brockwell P.J and Davis R.A. (2002) Introduction to Time Series and Forecasting (Second edition), Springer-Verlag.
2. Box G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden-Day.
3. Kendall M.G. (1978) Time Series, Charler Graffin.

AS4CD
Dissertation/Project

AS4CV
Viva-voce