MMA 1101 Bio-Statistics

Module I
Basic definitions and concepts
Variables and variation, frequency distributions, cumulative frequency distribution, sample and population measurement of spread of data, coding, precision, accuracy) **(3L)**

Module II
Samples
Introduction, random sampling, sampling procedures-stratified, systematic and cluster sampling, sampling in quality control. (3L)

Module III
Statistical Inference
Statistical estimation (confidence of intervals), statistical hypothesis testing composition of variances in independent samples, test of equality of more than two variables, confidence limits for a various tolerance intervals. (5L)

Module IV
Linear regression and correlation
Introduction, analysis of standard curves in Drug analysis-application of linear regression, assumptions of tests in hypothesis in linear regression, variance of sample estimates of the parameters, a Drug stability study-an example of the application of linear regression, confidence of intervals in regression analysis, weighted residuals, nonlinear regression.
(10L)

Module V
Analysis of variance
One-way analysis of variance, planned versus a Posteriori (Unplanned) comparisons in ANOVA, example of one-way analysis of variance-unequal sample sizes and fixed and random models, two-way analysis of variance (Randomized blocks). Statistical models analysis of covariance, ANOVA for pooling regression lines as related to stability data.
(10L)

Module VI
Quality control
Introduction, control charts, acceptance sampling and operating characteristic curves, statistical procedures in Assay Development, establishing in-house limits, some statistical aspects of quality and the "Barr Decision". (5L)

Text Books

Pharmaceutical Statistics
Practical and clinical applications 3rd Edn. By Sanford Bolton, 1997
Marcel, Dekker.

MMA 1105 Computational Mathematics

Module I & II

Partial Differential Equations:

Classification of partial differential equations. Its characteristics and reduction to canonical forms. Affine transformation. Solution of higher order p.d.e with variableco-efficients by Monge's method. Boundary value Problems. Two dimensional heat conduction equation. Laplac's equation in different co-ordinate systems. Vibrating membrane. (12L)

Module III

Calculus of Variations:

Extrema of functions of several variables, Lagrange's Multipliers. External properties of the characteristic values of (A- B) X=0. The Euler equation of

Variations, the extrema of integrals under constraints. Sturm-Liouville Problems. Hamilton's principle and Lagrange's equations. (6L)

Module IV

Eigen values and eigen vectors of Matrices:

Basic properties of eigen values and eigen vectors. The power method. The Rayleigh quotient. Inverse iteration. Jacobi's methods, Given and Household's methods. Leverriar – Faddeeva method. Sylvester's expansion theorem and Computation of f(A). (6L)

Module V

Numerical method: Finite difference method for parabolic, elliptic and hyperbolic equations. Explicit and implicit schemes. Convergence and Stability of schemes. (6L)

Module VI

Introduction to finite element method.

Concept of functionals. Rayleigh Ritz and Galerkin's Techniques. Application to two dimensional problems. Finite element method for one dimensional problems. Application to two dimensional problems. (6L)

1. Advanced Engineering Mathematics – E. Kreyszig

2. Linear Partial Differential Equations for Scientists and Engineers, Lokenath Debnath and Tyn Myint U., Fourth Edition, Birkhauser, Boston.

3. I.N.Sneddon, Elements of Partial Differential Equations, **McGraw Hill, NewYork.**

4. Energy and variational Methods in Applied mechanics by J.N. Reddy.

5. The Finite Element Method by O.C. Zienkiewicz.

6. Introductory methods of Numerical analysis; S S Sastry, Prentic Hall, INDIA

7. An Introduction to the Finite Element Method; J N Reddy ; McGraw Hill

MMA 1107 Probability and Statistical Analysis

Module I

Probability Theory

Random Experiment Mathematical or Apriori Definition of Probability, Statistical or Aposteriori Definition of Probability, Axiomatic Definition Probability, Conditional Probability independent Events, Theorem of Total Probability, Baye's Theorem or Theorem of Probability of Causes, Bernoulli's Trails De Moivre Laplace Approximation, Generalisation of Bernoulli's Theorem Multinomial Distribution (4)

Module II

Random Variables

Descrete Random Variable, Probability Function, Continuous Random variable, Probaility Density Function Cumulative Distribution Function, (cdf), Properties of the cdf F (x), Special Distributions, Discrete Distributions, Continuous Distributions, Two-Dimensional Random Variables, Probability Function of (x,y), Joint Probability Density Function, Cumulative Distribution Function, Properties of F (x,y), Marginal Probability Distribution, Conditional Probability Distribution, Independent RVs, Random Vectors, Marginal Probability Distribution of X I, pi* , Marginal Probability Distribution of Y: j, p*j . (6)

Module III

Functions of Random Variables

Function of One Random Variable, One Function of Two Random Variables, Statistical Averages. Expected Values of a Two-Dimensional RV, Properties of Expected Values, Convariance and Correlation, Properties, Conditional Expected Values, Characteristic functions Properties of MGF, Properties of Characteristic Function, Comulant Generating Function (CGF), Jaoint Characteristic Function (CGF). (6)

Module IV

Special Probability Distributions

Introduction, Special Discrete Distributions – Binomial, Poisson, Geometric and Hyper geometric Distributions and their Properties (mean, Variance etc) Special Continuos Distributions –Uniform, Exponential, Erlang and Normal Distributions as There Properties. (4)

Module V

Tests of Hypotheses

Parameters and Statistics, Sampling Distribution, Estimation and Testing of Hypotheses, Tests of significance, errors, Tailed Tests, critical values, Student's T – Distribution, Snedector's F – Distribution and Chi-squar5e Distribution and Their uses and Properties. (6L)

Module VI

Random Processes

Classifiation of Randjom Processes, Methods of Description of a Random Process, Special Classes of Random Process A cerge Values of Random Processes, Stationarily, Example of a SSS Process, Analytical Representation of a Random Process, Autocorrelation Function and Its Properties of R (t),

Special Random Processes

Definition of Gaussian Process, Properties, Processes Depending on Stationary Gaussian Process, Poisson Process, Probability law for the poison Process X (t) Second – Order Probability Function of a Homogeneous, Poisson Process, Mean and Autocorrelation of the

Poisson Process, Properties of Poisson Process, Markov Process, Definition of a Markov Chain, Chapman – Kolmogorov Theorem, Classification of States of Markov Chain
Reliability Engineering:
Concepts of Reliability, Reliability of Systems, Maintainability and Availability. (10L)

Text. Book:

T. Veerarajan – Probability, Statistical, Random Processes 2nd Ed., TMB, New Delhi, 2003.

Reference Book:

1. A. Papoulis & S.V. Pillai – Probability, random Variables and Stochastic Processes, 4th Ed., TMB, New Delhi.
2. S.K. Ross-Probability Models, 6th Ed. Harcourt Asia Pte Ltd, New Delhi, 2000.
3. R.V. Hogg and A.T. Craig – Introduction to Mathematical Statistics, 5th Ed, Pearson Education, New Delhi 2004.
4. J.E. Freund and R.E. Walpole, Mathematical Statistics, 5th Ed., PHI, New Delhi, 2000.

MMA 1109 Numerical and Statistical Methods (3-0-0-3)

Numerical Methods

Module I

Errors in Numerical Calculations: Errors & their computation-absolute, relative & percentage.

Solution of algebraic & transcendental equations: Introduction, Bisection method, Iterative method, False position method, Newton's Raphson method, Lin-Baistows method. Error analysis & convergence study. (5L)

Module II

Interpolation with equal & unequal intervals: Introduction, finite differences-forward, backward & central, difference tables, differences of polynomials, Newton's formula for interpolation, Gauss's central difference interpolation formula, Divided difference & their properties – Newton's divided differences formula, Lagrange's interpolation formula, Inverse interpolation.

Numerical solution of linear system of equations: Direct method-Gauss elimination, Gauss-Jordan, LU decomposition methods. Iterative methods--Gauss-Jacobi & Gauss Seidel methods. **(5L)**

Module III

Numerical differential & integration: Introduction, derivatives using forward & backward difference formula, Numerical integration – Trapezoidal rule, Simpson's 1/3 & 3/8 rules Weddle's rule.

Numerical solution ordinary differential equations: Taylor Series method, Euler's method, Modified Euler's method, Ranga-Kutta methods of 2^{nd} & 4^{th} order, Predictor-Corrector methods (Milne's method and Adam's methods). (5L)

Statistical Methods

Module IV

Concepts of Probability: Experiment and Sample Space, Events and Operations with Events Probability of an Event, Basic Probability Rules, Applications of Probability Rules, Conditional Probability.

Random Variables: How Random Variable Arise, Probability Distribution of a Random Variable, Mean or Expected Value of a Random Variable, Probability Histogram Value of a Random Variable, Variance and Standard Deviation of Random Variable. (5L)

Module V

Binomial Experiments: Structure of a Binomial Experiment, Binomial Probability Distribution, Use of Binomial Probability Table.

Normal Curve and Normal Distribution: Motivation behind a Normal Curve, Properties of a Normal Curve, Normal Probability Distribution, Areas under a Normal Curve.

Applications of the Normal Distribution: Approximating a Binomial Probability, The Normal Theorem and the Central Limit Theorem. (6L)

Module VI

Estimation of Population Parameters: Parameter and Statistic, Point and Interval Estimation, Interval Estimation of Three Common Parameters.

Hypothesis Testing for a Single Population: Concept of a Hypothesis, Tests Involving a Population Mean, Tests Involving a Population Proportion, Tests Involving a Population Standard Deviation.

Hypothesis Testing to Compare Two Populations: Comparison of Two Popu7lations, Tests for Two Population Means, Tests for Two Population Means, Tests for Two Population Proportions, Tests for Two Population Variance.

Bivariate Quantitative Data – Correlation and Regression: Concepts of a Bivariate Data Set, Correlation Coefficient, Inferences on a Population Correlation Coefficient, The Regression Line Inferences on the Population Regression Line. (10L)

Text Books:

1. S. S. Sastry-Introductory Methods of Numerical Analysis – PHI, Private Ltd., New Delhi-2006.
2. R.L. Burden & J.D. Faires – Numerical Analysis, Thomson Learning-Brooks/Cole, Indian Reprint, 2006
3. R V Hogg et al- Probability and Statistical Inpane, 7th ed. Pearson Education
4. R L Burden & J D Faires –Numerical Analysis, Thomson Learning-Brooks/ Cole, Indian Reprint,2005.

MMA 1110 Numerical and Statistical Methods Lab (0-0-3-2)

MMA 1111 Optimization Theory

Module I
Operation Research – An overview, Organ and Development of OR, Nature and Features of OR, Modeling in OR, General Solution Methods for OR models, Scientific method in OR, Methodology of OR, Application, Opportunities and Shortcomings of OR (5L)

Module II
Linear Programming Problem: Introduction, Mathematiczal Formulaktion of the Probhlem, Graphical Solution Method, Some Exceptional Cases, General LPP, Canonical and Standard forms of LPP, implex Method: Introduction, Fundamental properties of solution, the Computational Procedure, Use of Artificial variables, Solution to simulation Linear Equations, Investing a Matrix using Simplex Method. (5L)

Module III
Duality in LPP: Introduction, General Primal – Dual pair, Formulating a Dual Prkoblem, Primal Dual pair in Matrix form, Dhaliting theorems, Dual simplex method, Post optical Analysis, Introduction: Variation in cost vector, Requirement Vector, Coefficient Matrix, Structural Variation. (6L)

Module IV
Integer Programming and Advance LPP techniques: Introduction Gomory's Method, Courtruction of Gomory's constraints, Fractional Cut Method All Integer & Mixed Integer, Revised Simplex Method, Bounded Variable, Parametric LPP, Karmakar Algorith.(6L)

Module V
Dynamic Programming & Introduction: Characteristic of Dynamic Programming, Dynamic Programming Algorithm, Solution of OPP by Dynamic Programming. (4L)

Module VI
NLPP: Introduction, Formulality a NLPP, Constrained Optimization with Equality Constraints and Inequality constraints, Saddle Points.
NLPP Methods: Introducktion, Graphical solution, Kuhn – Tucker Conditions with Non Negative Constraints, Quadratic Programming, Wolfe's Modified Simplex Method, Separable Convex Programming & Algorithm. (10L)

Text Bookk:

1. Kanti Swarup, P.K. Gupta, Man Mohan – "Operations Research Sultan Chand & Sons, New Delhi – 2001.

Reference Books:
1. Ronald L., Rardin "Optimization in Operations Research", pearson Education, New Delhi – 2003.
2. S.S. Rao, " Optimization Theory & Application", Wiley Eastern Ltd, 1979.

MMA 1113 Geo-Statistics

Module I

Elementary Statistics: Collecting of Data, Basic Principles, Retrospective study, observational study, designed Experiments, observing Process over time. Organization of data: Review of frequency distribution. Presentation of Data: Tables, Diagrams – Geometric Form (bar diagrams, pie-diagrams), Frequency Diagrams (histogram, polygon), Arithmetic Line Graphs (time series graph). Measure of Central tendency, Measures of location, Dispersion, Skewness, Kurtosis. (6L)

Module II

Mathematical Statistics & Probability: Moments, Central Moments; Curve Fitting, Method of Least Square. Linear Correlation, Rank Correlation and Simple Linear Regression Analysis.

Probability Distribution, Discrete & Continuous Probability Distribution. Binomial, Poisson & Normal Distribution with Application. Brief description of Geometric Exponentials with application. (6L)

Module III

Sampling & Regression: Multiple & Partial Correlation, Multiple Regression, Random Variable, Mathematical Expectations.

Concept of Probability, Addition, Multiplication & Bay's Theorem of Probability, Random Sampling, Stem & Leaf Diagrams. (5L)

Module IV

Testing Of Hypothesis: Hypothesis Testing, Statistical hypotheses, Test of statistical hypotheses, One sides & two sides hypotheses, testing ; test on the mean of normal distribution variance known . Test on the mean of normal distribution variance unknown, test on the variance & standard deviation of normal distribution (6L)

Module V

Statistical Inference: Brief Review of Sampling Theory, Sampling Distribution; Concept of Estimating Theory, Point & Internal Estimating; Testing of Hypothesis for small and Large Samples; Test for Population Mean & Difference Between Two Means, Chi-Square Test. (5L)

Module VI

Variance 7 Covariance: Analysis of Variance, One way & Two ways Analysis of Variance Test; Theory of Random Process, Model Validation; Simulation of data, Linear & Non Linear Regression Model; Multiple & Stepwise Regression Modeling

Kriging: The Krikging Paradigm, Simple Kriging, Ordinary Kriging;. Brock, Factorial & Dual Kriging. (8L)

REFERENCES

1. Paul L. Meyer, 2006, "Introductory Probability and Statisktical Applications"Addison Wesley
2. Chiles, J. P. (1999). Geo-statistics: Modelling spatial uncertainty, Wiley Interscience Publ.
3. Sharma, D. Dl. (2002). Geo-statistics with application in Earth Sciences, Capital Publ. .
4. Murray R. Spiegel, (2008), Theory and Problems of Statistics, Schaum's Outline Series.

MMA 1115 Discrete Mathematics (MCA)

Module I

Fundamentals: Sets and Subsets, Operations on Sets, Properties of Integers, Mathematical Structures.

Logic: Propositions and Logickal Operations Conditional Statements, Method proof Mathematical Induction (6)

Module II & Module III

Counting: Permutation, Combination, Pigeonhole Principle, Elements of Probability.

Relations and Digraphs: Product Sets and Partitions, Relations and Digraphs, Paths in a Digraph, Properties of Relations, Equivalence Relations, Computer Representation of Relations and Digraphs, Operations on Relation, Transitive Closure and Wars hall's Algorithm. (12)

Module IV

Functions: Functions, Functionsj for Computer Science, Growth of Functions, Permutation Functions.

Order Relations and Structures: Partial Ordered Sets,

External Elements of Partially Ordered Sets, Lattices, Finite Boolean Algebra Circuit Design. (6)

Module V

Trees: Trees, Labelled Trees, Tree Searching Undirected Trees. Minimum Spanning Trees. (6)

Module VI

Semigroups and Groups: Binary Operations, Semigroups, Products and Quotients of Semigroups, Groups, Products and Quotients of Groups. (6)

Text Book:

1. Discrete Mathematical Structures, Kolman, Busby, Ross 5th Ediktion, Pearson Eduction.
2. Discrete Mathematics, Swapan Kumar Chakraborty & Bikash Kanti Sarkar, 1st Ed., Oxford Univ. Press, 2011.

Reference Books:

1. R. Johnsonbargh – Discrete Mathematics, 6th Edn, Pearson Education, New Delhi – 2007
2. K.H. Rosen – Discrete Mathematics and Itrs Applications, 4th Edn, TMH, New Delhi-2001.