BON SECOURS COLLEGE FOR WOMEN (AUTONOMOUS)

VILAR BYPASS, THANJAVUR – 613006

OPERATIONS RESEARCH - 24UMA302

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to
Unit – I	**CO1**	Formulate real-world problems as linear programming models.
Unit – II	**CO2**	Apply the simplex method for solving linear programming problems.
Unit - III	**CO3**	Understand the principles and applications of the Northwest Corner Rule in transportation problems.
Unit - IV	**CO4**	Analyze the complexity of different job sequencing algorithms and methods.
Unit - V	**CO5**	Formulate project networks and identify critical activities and paths.

SYLLABUS:

UNIT – I: Linear Programming Problem

Introduction – LPP - Mathematical Formulation of LPP, LPP by Graphical Solution Method , Canonical and Standard form of LPP, Solutions to LPP by Simplex method and Big-M Method.

UNIT – II : Transportation problem

Transportation algorithm –Degeneracy algorithm – Degeneracy in Transportation Problem, Unbalanced transportation problem

UNIT – III: Assignment and sequencing problem

Assignment algorithm and problems – Unbalanced Assignment problem

Sequencing problem: Processing of n jobs through two machines – Processing of n jobs through 3 machines – processing of two jobs through m machines.

UNIT – IV: Games Theory

Introduction - Pay off – Types of Games – The Maximin – Minimax Principle – Games without saddle points (Mixed Strategies).

UNIT – V: Networks

Network – Fulkerson‘s rule - measure of activity – PERT computation – CPM computation - Resource scheduling

Text Book:

Kalavathy S, Operations Research (2013), Fourth edition, Vikas Publishing House PVT.Ltd.

Unit-I Chapter 2, Section: 2.1 to 2.3
Chapter 3, Section: 3.1 to 3.4
Chapter 4, Section: 4.1,4.2
Chapter 5, Section: 5.1,5.2

Unit-II Chapter 8, Section: 8.1 to 8.5

Unit-III Chapter 9 - Section : 9.3 to 9.6
Chapter 14 - Section: 14.1 to 14.3, 14.5

Unit-IV Chapter 19 - Section: 19.1 to 19.5

Unit-V Chapter 15 Section 15.1 to 15.8

LINEAR ALGEBRA AND CALCULUS - 24UMA304

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to
Unit - I	CO 1	Understand the Vector Space, Norm, Dot Product Orthogonally
Unit - II	CO 2	Recall the Complex vector space & Differential Equation
Unit - III	CO 3	Apply the Partial Differentiation & Euler's Theorem
Unit - IV	CO 4	Compare the Type of Integrals
Unit - V	CO 5	Understand the Differential Equation

Syllabus

UNIT I

Euclidean Vector Space: Vector in 2-Space, 3-Space and n-Spaces – Norm, Dot Product and Distance in R^n -Orthogonality – The Geometry of linear Systems – Cross Product

UNIT II

Eigenvalues and Eigenvectors: Eigen values and eigen vectors – Diagonalization – Complex Vector Spaces – Differential Equation

UNIT III

Inner Product Spaces: Inner Products- Angle and Orthogonality in Inner Product spaces - Gram-Schmidt Process - QR Decomposition Best Approximation: least Squares - Fitting to Data.

UNIT IV

Integration : Evaluation of integrals of types:

1. $\int \frac{px+q}{ax^2+bx+c}$ 2. $\int \frac{px+q}{\sqrt{ax^2+bx+c}}$ 3. $\int \frac{ax}{a+bcosx}$ 4. $\int \frac{ax}{a+bsinx}$

Evaluation using integration by parts - Properties of define integrals- Fourier series in the range $(0,2\pi)$ – odd &Even function – Fourier half range sine & cosine series.

UNIT V

Differential Equations: Variables Separable – Linear equations – Second order of types $(aD^2 + bD + c)y = F(x)$ where a,b,c are constants and $F(x)$ is one of the following types

(i)e^{Kx} (ii) $\sin(kx)$ or $\cos(kx)$ (iii)x^n, n being an integer (iv)$e^{Kx}f(x)$

Text Book:

1.Wiley. -Elementary Linear Algebra with supplemental Applications - Howard Anton –Drexel University and Chris Rorres University of Pennsylvania Eleventh Edition.

Unit-I Chapter: 3(Full)

Unit – II Chapter :5(Full)

Unit - III Chapter : 6 Sec 1 to 5

2.S.Narayanan, T.K. Manicavachagam Pillai Calculus, Vol II S. Viswanathan Pvt Limited,2011.

Unit-IV Chapter1 section: 7.3 ,8,9,11

3. S.Narayanan, T.K. Manicavachagam Pillai Calculus, Vol III S. Viswanathan Pvt Limited,2011.

Unit – IV chapter 6 section: 1,2,3,4,5

Unit-V Chapter1 section 2,1 to 2.4, chapter2 : section 1.2 to 1.4

APPLIED MATHEMATICS - 24UMA306

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to
Unit - I	**CO1**	Understand the concepts of ODE and apply this concept for dynamic Problem
Unit - II	**CO2**	Recognize the Ordinary differential Equations and Partial Differential Equations
Unit - III	**CO3**	Understand the Laplace transforms
Unit - IV	**CO4**	Understand the concept of transforms and Apply conversion method.
Unit - V	**CO5**	Recognize the Vector and line Equations and find divergence of a Vector

Syllabus

UNIT – I: Ordinary Differential Equation

Introduction, symbolic operators, method of finding Complementary function, symbolic operator $\frac{1}{f(D)}$ method of finding particular integral, short method of finding PI, To find Particular Integral when X=e^{ax} where 'a' is a constant, To find PI when X=cos ax *and* sin ax where 'a' is a constant, d to find the value of $\frac{1}{f(D)} X^m$ where 'm' is a positive interger.

UNIT – II : Partial Differential Equations

Formation of Partial differential equations by eliminating constants and by elimination of arbitrary functions - definition of general, particular & complete solutions - Singular integral (geometrical meaning not required) — Solutions of first order equations in the standard forms

- f(p,q) = 0, f(x,p,q) = 0, f(y,p,q) = 0, f(z,p,q) = 0, $f_1(x,p) = f_2(x,p)$, z = xp + yq + f(p,q) - Lagrange's method of solving Pp + Qq = R ,where P,Q,R are functions of x,y,z- (GeometricalMeaning is not needed)- (only problems in all the above - No proof needed for any formula)

UNIT – III: Laplace Transform

The Laplace Transform ,Convergence , Continuity Requirements ,Exponential Order .TheClass L ,Basic Properties of the Laplace Transform .

UNIT – IV: Inverse of the Laplace Transform

Inverse of the Laplace Transform, Translation Theorems, Differentiation and Integration ofthe Laplace Transform , Partial Fractions .

UNIT – V: Vector Calculus

Gradient of a vector ,directional derivative ,unit normal vector tangent plane ,Divergence- Curl , Solenoidal & Irrotational vectors, Double operators Properties connecting grad., div.,and curl of a vector

Text Book:

1. Allied Mathematics, Margam Publications , P.R Vittal.

   Unit I: Chapter 22 – Sec 1 & 2, Chapter 23

   Unit II: Chapter 26 – Sec 1 to 8

   Unit III: Chapter 27 – Sec 1 to 3

   Unit IV: Chapter 27 – Sec 4 &.5

   Unit V: Chapter 28

OPERATIONS RESEARCH - 24UMA308

Course Outcome:

Unit	CO No	Upon completion of the course the students will be able to
I	CO1	Apply operations research techniques to formulate and solve linear programming models using the graphical method in simple business contexts
II	CO2	Analyze various methods for finding feasible and optimal solutions to transportation problems, determining the most cost-effective approach for different scenarios
III	CO3	Analyze assignment and sequencing problems by evaluating optimal solutions using the Hungarian method and sequencing techniques, and assess the impact of job scheduling decisions on overall operational efficiency.
IV	CO4	Analyze project timelines using PERT and CPM, constructing network diagrams and identifying critical paths to optimize project completion times.
V	CO5	Analyze competitive and uncertain decision-making scenarios using game theory techniques (such as the maximin-minimax criterion and dominance property) and decision theory tools (like Bayes' theorem and decision trees) to determine optimal strategies.

Syllabus

Unit I

Introduction to Operation Research: Meaning, Evolution, approaches, techniques and scopes of operations research, Linear Programming problem - general mathematical model of LPP, steps of L.P model formulation, Graphical method of the solution of LPP- simple problems.

Unit II

Transportation problem- Basic definitions, formulation of transportation problem as LPP, finding an initial basic feasible solution- North -west corner rule, row minima method, column minima method, least cost entry method-Vogel's approximation method to find the optimal solution.

Unit III

Assignment problem-Hungarian method- Minimization and Maximization case, unbalanced assignment problem. Sequencing Problem-Processing N jobs on 2 machines, processing N jobs on 3 machines, processing N jobs on M machines.

Unit IV

Network models-PERT and CPM — difference between PERT and CPM- constructing network- critical path, various floats, three-time estimates for PERT

Unit V

Game Theory- Maximin-Minmax criterion, Saddle point, Dominance property, Graphical method for solving 2xn and mx2 game. Decision Theory –statement of Baye's theorem application - decision trees.

Text Book:

1. Kalavathy S, Operations Research (2013), Fourth edition, Vikas Publishing House PVT.Ltd.

Unit-I Chapter 1, Section 1.1, 1.6
Chapter 2, Section: 2.1 to 2.2
Chapter 3, Section: 3.1

Unit-II Chapter 8, Section: 8.1 to 8.5

Unit-III Chapter 9 - Section : 9.3 to 9.6
Chapter 14 - Section: 14.1 to 14.4

Unit-IV Chapter 15 Section 15.1 to 15.7

Unit-V Chapter 19 - Section: 19.1 to 19.5

BASIC STATISTICS - II

24UMA310

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to
Unit – I	CO 1	Understanding how sample statistics vary with different sample sizes.
Unit - II	CO 2	Constructing and interpreting confidence intervals for populations and means.
Unit - III	CO 3	Learning to formulate and test hypotheses about population parameters.
Unit - IV	CO 4	Comparing two population means and two proportions using appropriate statistical tests.
Unit – V	CO 5	Exploring multiple regression models to understand relationships between a dependent variable and multiple independent variables.

Syllabus

UNIT – I

Probability Distributions:

Sampling distribution describe how Statistics Vary, Sampling distributions of sample means, Review: Population, Sample Data, and Sampling Distributions.

UNIT – II

Statistical Inference Estimation:

Point and Interval Estimation, confidence Interval for a Proportion, Confidence Interval for a Mean.

UNIT – III

Statistical Inference: Significance tests

The five parts of a significance test, Signification test for a mean, Signification test for a proportion.

UNIT – IV

Comparison of two groups:

Preliminaries for comparing groups, Categorical data: Comparing two proportions, Quantitative data: Comparing two means.

UNIT – V

Multiple Regression and Correlation: The Multiple regression model – Multiple correlation and R^2 – Inferences for multiple regression coefficients

Text Book:

Agresti, Alan, Statistical Methods for the Social Sciences, Fifth Edition(2018), Global Edition, Pearson.

Unit I : Chapter 4 – Sec 4.4 to 4.6

Unit II : Chapter 5 – Sec 5.1 to 5.3

Unit III : Chapter 6 – Sec 6.1 to 6.3

Unit IV : Chapter 7 – Sec 7.1 to 7.3

Unit V : Chapter 11 – Sec 11.1 to 11.3

BON SECOURS COLLEGE FOR WOMEN (AUTONOMOUS)

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Affiliated to Bharathidasan University, Tiruchirappalli
UGC Recognized 2(f) and 12(B) Institution
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B.Com & B.ComCA

24UMA312: Quantitative Techniques for Decision Making

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to
Unit – I	CO 1	Explain the concept of Correlation, types of correlation, regression and calculate correlation and regression coefficient.
Unit – II	CO 2	Define index numbers, the pros and cons of index numbers and construct index numbers using different methods
Unit – III	CO 3	Appraise the importance of time series analysis and compute trends using different methods.
Unit – IV	CO 4	Examine the concept of probability and calculate probability using different theorems
Unit – V	CO 5	Discuss the concept of binomial distribution, properties, importance and work out problems on binomial, poison and normal distribution.

Syllabus

UNIT -I: Correlation & Regression

Correlation: Introduction-Meaning-Definition-Uses and Types of Correlation, Problems on Methods of Studying Correlation: Karl Pearson's coefficient of correlation, Spearman's Rank correlation and Concurrent Deviations Method –Probable Error.

Regression: Introduction-Meaning-Definition-Utility of Regression Analysis-Properties of Regression Co-efficient- Difference between Correlation and Regression-Problems Regression equations.

UNIT -II: Index Numbers

Introduction -Meaning –Definition-Importance and Limitations of Index Numbers- Problems on methods of construction of Index Numbers – (Unweight Index Numbers: Simple Agrregative method and Simple Average of Relatives Using Arithmetic Mean only-Weighted: Laspeyres – Paasches, Bowley's and fisher's only) –Tests of Adequacy of Index Number:Time Reversal Test and Factor Reversal Test - Cost of living Index Numbers.

UNIT-III: Analysis of Time series

Introduction -Meaning, Importance of Time Series Analysis – Components of Time series – Problems on Methods of Measurement of Trend: Simple Averages method, Moving Averages Method and Fitting a straight line Trend by method of Least squares

UNIT - IV: Probability

Introduction – Meaning – Definition-Terminology of probability - Theorems of probability: Addition Theorem- Multiplication Theorem-Conditional Probability – Bayer's Theorem – Meaning-Mathematical Expectation - Simple problems.

UNIT – V: Theoretical Distributions

Introduction – Meaning of Binomial Distribution –Coefficients of the Binomial Distribution Properties of Binomial Distribution-Constants of Binomial Distribution-Importance of Binomial Distribution-Fitting a Binomial Distribution(Theory)-Simple Problems on Binomial Distribution Meaning of Poisson Distribution –Constants of Poisson Distribution-Role of Poisson Distribution(Theory)-Fitting a Poisson Distribution-Simple Problems on Poisson Distribution – Meaning of Normal Distribution –Relationship between Binomial ,Poisson and Normal Distribution-Properties of Normal Distribution-Importance of Normal Distribution-Conditions of Normality(Theory)-Fitting a Normal Curve-Simple Problems on Normal Distribution.

Text Book:

1. R.S.N. Pillai & Bagavathi, Statistics. S. Chand Publishing, 8thEdition, 2021.
   Unit – I: Chapter – 12,13
   Unit – II: Chapter – 14
   Unit – III: Chapter – 15
   Unit – IV: Chapter – 18
   Unit – V: Chapter – 19

Reference Books:

1. Statistical Methods: S.P. Gupta, S. Chand & Sons. 2021, New Delhi, 46th Revised Edition,
2. Fundamentals of Statistics :S.C.Gupta , 7th Revised Edition,2020, Himalaya Pub. House, Bombay, Statistics (Theory, Methods & Applications): Sancheti D.C. & Kapoor V., S.Chand & Sons. Revised Edition 2011
3. Quantitative Techniques for Managerial Decision making :Srivatsava U.K. &. Sharma, Wiley Eastern, Revised Edition, 2011.
4. Fundamental of Mathematical Statistics : S.C.Gupta &V.K.Kapoor , S.Chand & Sons, N.Delhi, Revised Edition 2010

B.Sc. Data Science

24UMA316: Statistical Inference

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to
Unit – I	CO 1	Understand different types of data and calculate various measures of central tendency including mean, median, mode, geometric mean, and harmonic mean.
Unit – II	CO 2	Analyze data dispersion using measures like range, quartile deviation, mean and standard deviation, and interpret skewness and kurtosis.
Unit – III	CO 3	Apply probability concepts including axiomatic rules, conditional probability, and distinguish between discrete and continuous random variables.
Unit – IV	CO 4	Compute mathematical expectation, use moment generating functions, and determine conditional expectation and variance.
Unit – V	CO 5	Understand and apply Binomial and Poisson distributions, including calculation of moments and fitting distributions to data.

Syllabus

UNIT – I: Distributions of Sampling Statistics & Testing Statistical Hypotheses

Sample Mean - Central Limit - Sampling Proportions from a Finite Population - Distribution of the Sample Variance of a Normal Population Testing Statistical Hypotheses - Hypothesis Tests and Significance Levels - Tests Concerning the Mean of a Normal Population: Case of Known Variance - The t Test for the Mean of a Normal Population: Case of Unknown Variance- Hypothesis Tests Concerning Population Proportions

UNIT – II: Hypothesis Tests Concerning Two Populations

Testing Equality of Means of Two Normal Populations: Case of Known Variances - Testing Equality of Means: Unknown Variances and Large Sample Sizes - Testing Equality of Means: Small Sample Tests when the Unknown Population Variances Are Equal - Paired-Sample t Test - Testing Equality of Population

UNIT - III: Analysis of Variance

One-Factor Analysis of Variance - A Remark on the Degrees of Freedom - Two-Factor Analysis of Variance: Introduction and Parameter Estimation - Two-Factor Analysis of Variance: Testing Hypotheses

UNIT - IV: Linear Regression

Simple Linear Regression Model - Estimating the Regression Parameters - Error Random Variable - Testing the Hypothesis that $\beta = 0$ - Regression to the Mean - Prediction Intervals for Future Responses - Coefficient of Determination - Sample Correlation Coefficient - Analysis of Residuals: Assessing the Model - Multiple Linear Regression Model

UNIT - V: Chi-Squared Goodness-of - Fit Tests:

Chi-Squared Goodness-of - Fit - Testing for Independence in Populations Classified According to Two Characteristics - Testing for Independence in Contingency Tables with Fixed Marginal Totals - Nonparametric Hypotheses - Sign test – Signed Rank test

Text Book:

1. Sheldon M. Ross, "Introductory Statistics", 4th Edition 2017. Academic Press of Elsevier,

Unit -I: Chapter 7 – Sec 7.1 to 7.6

Chapter 9 – Sec 9.1 to 9.5

Unit - II: Chapter 10 – Sec 10.1 to 10.6

Unit-III: Chapter 11 – Sec 11.1 to 11.4

Unit-IV: Chapter 12 – Sec 12.1 to 12.11

Unit-V: Chapter 13 – Sec 13.1 to 13.4

Chapter 14 – Sec 14.1 to 14.3

Reference Books:

1. Deborah J. Rumsey, "Statistics II for Dummies", Wiley, 2021.
2. Allen B. Downey, "Think Stats Probability and Statistics for Programmers", 2011 Green Tea Press,
3. Peter Bruce and Andrew Bruce, "Practical Statistics for Data Scientists", 2017 O'Reilly Media, Inc.,
4. Tulsian, P.C., Jhunjhunwala B. Business statistics. (2020). S. Chand Publishing.

E- Resources:

1. https://www.khanacademy.org/math/statistics-probability
2. https://ocw.mit.edu
3. https://ndl.iitkgp.ac.in
4. http://www.ru.ac.bd/stat/wpcontent/uploads/sites/25/2019/03/102_03_Weiss-Introductory-Statistics2017.pdf
5. https://www.youtube.com/playlist?list=PL7y1rk2cCsA339crwXMWUaBRuLBvPBCg