

SEMESTER – III
USMAAn20 – Numerical Methods

Year: II SEM: III	Course Code: USMAAn20	Title of the Course: Numerical Methods	Course Type: Theory	Course Category: Skill Based Elective	H/W 2	CREDITS 2	MARKS 100
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Course Objectives

1. To introduce various concepts of numerical methods.
2. To apply them and obtain the approximate solutions to mathematical problems.

Course Outcomes (CO)

The learners will be able to

1. Understand the operators of finite differences and express any value of y in terms of the forward differences of y_0 and the backward differences of y_n .
2. Apply interpolating techniques for equal intervals by Newton's method.
3. Apply central difference formulae to get the intermediate values of given data.
4. Apply interpolating techniques for unequal intervals by divided difference formula and Lagrange's interpolation formula.
5. Evaluate the gradient at any point of a graph using numerical differentiation and find the area under curved surface, velocity, etc. using numerical integration.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	H	L
CO2	H	H	M	H	H	L
CO3	H	H	M	H	H	L
CO4	H	H	M	H	H	L
CO5	H	H	M	M	H	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	L	L	M
CO5	H	H	H	L	L	M

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Finite Differences

(6 hours)

First difference – Operators: $\Delta, \nabla, \mu, \delta$, E and D - Properties of operators – Relation between the operators - Express any value of y in terms of y_n and the backward differences of y_n - Differences of a polynomial – Factorial polynomial. (K1, K2, K3, K4)

Unit II: Interpolation with Equal Intervals

(6 hours)

Gregory-Newton forward interpolation formula (for equal intervals) – Gregory-Newton Backward interpolation formula (for equal intervals) - Equidistant terms with one or more missing values (K1, K2, K3, K4)

Unit III: Central Difference Interpolation Formulae

(6 hours)

Central differences and central differences table – Gauss's forward interpolation formula – Gauss's backward interpolation formula- Stirling's formula – Bessel's formula. (K1, K2, K3, K4)

Unit IV: Interpolation with Unequal Intervals

(6 hours)

Divided differences – Properties of divided differences – Relation between divided differences and forward differences – Theorem: Newton's divided difference formula – Deduction: Deduce Gregory Newton interpolation forward formula for equal intervals- Lagrange's interpolation formula – Different form of Lagrange's interpolation formula. (K1, K2, K3, K4)

Unit V: Numerical Differentiation and Integration

(6 hours)

Newton's forward difference formula to get the derivative – Newton's Backward difference formula to get the derivative – Derivative using Stirling's formula- A general quadrature formula for equidistant ordinates–Trapezoidal rule –Simpson's one-third rule – Simpson's three-eighth rule. (K1, K2, K3, K4)

Text Book:

1. P.Kandasamy, K.Thilagavathyand K.Gunavathy- Numerical Methods-S.Chand publication- Revised Edition 2014.

Reference Books:

1. S.G. Venkatachalapathy – Calculus of Finite Differences and Numerical Analysis, Margham Publications, First edition 2003.
2. S.Kalavathy – Numerical Methods - Thomson Learning – 5, Shenton Way, Singapore. Copy Right: 2004.

3. Dr.A.Singaravelu – Numerical Methods – Meenakshi Agency - 120, Pushpa Nagar Medavakkam, Chennai, Revised Edition: Dec 2007.
4. Dr. V.N.Vedamurthy, Dr.N.Ch.S.N. Iyengar – Numerical Methods, Vikas Publishing House Pvt. Ltd, New Delhi, Copy Right: 1998.
5. S.Arumugam, A.Thangapandi Isaac, A. Somasundaram – Numerical Methods, Second Edition - SciTech Publishing Pvt. Ltd; Chennai - Reprint: Sep 2005.
6. R.Gupta – Numerical Analysis, Laxmi Publishing Ltd., New Delhi - Revised Edition, 2001.

e- Resources

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in/>

SEMESTER – IV
USMABn20 - R Programming Language

Year: II SEM: IV	Course Code: USMABn20	Title of the Course: R Programming Language	Course Type: Theory	Course Category: Skill Based Elective	H/W 2	CREDITS 2	HOURS 100
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Course Objectives

1. To introduce students to the concept of basic R programming, thereby enhancing the logical thinking of the students with regard to programming.
2. To train the students to apply the programming concepts of R to statistical investigations and problem solving.

Course Learning Outcomes (CLO)

The learners will be able to

1. Familiarize the basics of programming in R such as vectors, arrays, data frames, etc.
2. Use the Decision making-branching and looping statements in R programming.
3. Represent data and Interpret results through graphical tools in R.
4. Calculate basic statistical measures and fit standard distributions using R.
5. Understand and apply the programming concepts of R to perform tests of significance.
6. Understand and apply the programming concepts of R to perform Analysis of Variance.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	L	H
CO2	H	M	H	M	L	H
CO3	H	M	H	M	L	H
CO4	H	H	H	H	L	H
CO5	H	M	H	H	L	H

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	M	H
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Basics of R

(6 hours)

Introduction and Preliminaries-Simple Manipulations; Numbers and Vectors-Arrays and Matrices - Lists and Data Frames-Reading Data from files (K1, K2, K3, K4)

Unit II: Decision Making and Graphical Procedures

(6 hours)

Grouping-Loops and Conditional Execution-Graphics on R-Scatter Plot-Line Graphs-Pie Charts-Bar Plots-Histograms-Frequency Polygons (K1, K2, K3, K4)

Unit III: Statistical Measures & Probability Distributions

(6 hours)

Mean, Median and Mode-Variance, Standard Deviation and Mean Deviation -Correlation and Regression-Standard Distributions -Binomial, Poisson and Normal Distributions (K1, K2, K3, K4)

Unit IV: Tests of significance

(6 hours)

z-Test-Test for Mean-Test for Proportion-Comparing two Means-Comparing two proportions- Student t-test and t-test for two Means- Chi-Square Test-Test for Independence of Attributes (K1, K2, K3, K4)

Unit V: Analysis of Variance

(6 hours)

Comparing more than two Means-Completely Randomized Design - One-Way Classification-Randomized Block Design-Two-Way Classification-Latin Square Design (K1, K2, K3, K4)

Text Books:

1. The R Book-Michael J. Crawley-Imperial College London at Silwood Park, UK, Second Edition, A John Wiley & Sons, Ltd., Publication, 2013.
2. An Introduction to R-Notes on R: A Programming Environment for Data Analysis and Graphics W. N. Venables, D. M. Smith and the R Core Team-(Version 3.6.3), 2020.

Reference Books:

1. The Art of R Programming A Tour of Statistical Software Design-Norman Matloff, No Starch Press, San Francisco, 2011.
2. Introduction to Statistics with R - Anne Segonds-Pichon, Babraham Bioinformatics, 2015.
3. R for Dummies, Andrie de Vries and JorisMeys, 2nd Edition, John Wiley & Sons, Inc., 2015.

e-Resources:

1. <https://nptel.ac.in/>
2. www.coursera.org
3. <https://spoken-tutorial.org>

SEMESTER – V
USMAC20 – Mathematics for Competitive Examinations

Year: III SEM: V	Course Code: USMAC20	Title of the Course: Mathematics for Competitive Examinations	Course Type: Theory	Course Category: Skill Based Elective	H/W 2	CREDITS 2	MARKS 100
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Course Objectives

1. To improve the numerical ability and logical thinking of the students.
2. To prepare the students for various competitive examinations.

Course Outcomes (CO)

The learners will be able to

1. Apply the concepts of average, percentage, ratio and proportion to solve real life problems.
2. Think critically and solve problems.
3. Improve their creative thinking and make decisions in real life situations.
4. Determine the number of possible outcomes in a problem and calculate the probability of events for more complex outcomes.
5. Analyse and compare the given data to use analytic techniques that are simple and effective to solve problems.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	H	L
CO2	H	H	H	M	H	L
CO3	M	M	H	H	H	L
CO4	H	M	H	H	H	L
CO5	H	H	M	M	H	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	H	H	M	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Arithmetical Ability (6 hours)

Number system, Progression, Average, Ratio and Proportion (K1, K2, K3, K4)

Unit II: Arithmetical Ability (Continued) (6 hours)

Percentage, Profit and Loss, Interest, Time and Work, Time, Speed and Distance, Work and Wages (K1, K2, K3, K4)

Unit III: Arithmetical Ability (Continued) (6 hours)

Ages, Boats and Streams, Clocks and Calendar, Logarithms, Simplifications, Height and Distance (K1, K2, K3, K4)

Unit IV: Probability (6 hours)

Permutations and Combinations, Probability (K1, K2, K3, K4)

Unit V: Data Interpretation (6 hours)

Tabulation, Bar graph, Pie chart, Line graph (K1, K2, K3, K4)

Text Book:

1. Dr. R.S. Aggarwal, Quantitative Aptitude, S. Chand Publication, Revised Edition, Year 2018.

Reference Books:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, McGraw Education Series, 5th Edition 2019
2. Dinesh Khattar, Quantitative Aptitude for Competitive Examinations, Pearson India, Edition 2019.
3. Sarvesh K. Verma, Quantitative Aptitude Quantum CAT 2018, Arihant publication, Edition 2018.

e- Resources

1. <https://nptel.ac.in>
2. www.coursera.org
3. www.indiabix.com

SEMESTER – I
UCBAB20 – Business Mathematics and Statistics I

Year: I SEM: I	Course Code: UCBAB20	Title of the Course: Business Mathematics and Statistics – I	Course Type: Theory	Course Category: Core	H/W 5	CREDITS 4	MARKS 100
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Course Objectives

1. To introduce mathematical applications in business and management, thereby enhancing the logical thinking of the students with regard to problem solving.
2. To train the students to apply statistical techniques in business and management, thereby enhancing the decision making skills of the students.

Course Outcomes (CO)

The learners will be able to

1. Apply the concept of matrices in solving business problems.
2. Analyze and demonstrate differentiation skills in economics and business.
3. Apply graphical methods to interpret statistical data.
4. Apply the statistical techniques in business.
5. Solve a range of problems using the techniques covered.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	M	L
CO2	H	H	H	H	M	L
CO3	H	H	M	H	M	L
CO4	H	H	L	H	M	H
CO5	H	M	H	H	H	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	L	H
CO4	H	H	M	L	M	H
CO5	H	H	M	L	M	H

(Low-L, Medium - M, High - H)

Course Syllabus

Unit I: Matrices

(15 hours)

- 1.1. Definition, Types of matrices (K1, K2, K3, K4)

- 1.2 Matrix operations, Determinant of a matrix (K1, K2, K3, K4)
- 1.3 Singular and non-singular matrices(K1, K2, K3, K4)
- 1.4 Inverse of a matrix by co-factor method (K1, K2, K3, K4)
- 1.5 Rank of a matrix (K1, K2, K3, K4)
- 1.6 Solution of system of linear simultaneous equations using Cramer's rule (K1, K2, K3, K4)

Unit II: Differentiation

(15 hours)

- 2.1 Differentiation (K1, K2, K3, K4)
- 2.2 Derivatives of standard functions x^n , e^x , $\log x$, constant (without proof) (K1, K2, K3, K4)
- 2.3 Rules of differentiation (Addition, difference, product, quotient) (K1, K2, K3, K4)
- 2.4 Chain rule, Successive differentiation (up to second derivative) (K1, K2, K3, K4)

- 2.5 Uses: Marginal Concepts, Elasticity of demand, Increasing and decreasing functions (K1, K2, K3, K4)
- 2.6 Maxima and minima, break - even point. (K1, K2, K3, K4)

Unit III: Classification and Graphical Representation

(15 hours)

- 3.1 Introduction, meaning of classification, chief characteristics of classification, objects of classification rules of classification (K1, K2, K3, K4)
- 3.2 Frequency distribution, individual observations (K1, K2, K3, K4)
- 3.3 Discrete frequency distributions continuous frequency distribution (K1, K2, K3, K4)
- 3.4 Frequency distribution, graph of frequency distribution (K1, K2, K3, K4)
- 3.5 Histogram (K1, K2, K3, K4)
- 3.6 Frequency polygon, frequency curve. (K1, K2, K3, K4)

Unit IV: Measures of Central Tendency

(15 hours)

- 4.1 Arithmetic mean (K1, K2, K3, K4)
- 4.2 Median (K1, K2, K3, K4)
- 4.3 Mode (K1, K2, K3, K4)
- 4.4 Empirical formulae, Combined and Weighted arithmetic mean (K1, K2, K3, K4)
- 4.5 Geometric mean (K1, K2, K3, K4)
- 4.6 Harmonic mean. (K1, K2, K3, K4)

Unit V: Measures of Dispersion and Skewness

(15 hours)

- 5.1 Range (K1, K2, K3, K4)
- 5.2 Quartile deviation (K1, K2, K3, K4)
- 5.3 Mean deviation (K1, K2, K3, K4)
- 5.4 Standard deviation (K1, K2, K3, K4)
- 5.5 Karl Pearson's coefficient of skewness (K1, K2, K3, K4)
- 5.6 Bowley's coefficient of skewness. (K1, K2, K3, K4)

Text Books:

1. P. A. Navnitham - Business Mathematics and Statistics - Jai Publishers - Trichy 2007.
2. R. S. N. Pillai and Bagavathi - Statistics, 17th Edition, S. Chand and Company - New Delhi, 1984.

Reference Books:

1. Francis, Andy - Business mathematics and statistics. Cengage Learning EMEA, 2004.

2. Agarwal, B. M. - Business Mathematics & Statistics. Ane Books Pvt Ltd, 2009.
3. Asim Kumar Manna - Business Mathematics & Statistics. McGraw Hill Education (India) Pvt. Ltd., 2018.

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – II
UCBAD20 - Business Mathematics and Statistics - II

Year: I SEM: II	Course Code: UCBAD20	Title of the Course: Business Mathematics and Statistics – II	Course Type: Theory	Course Category: Core	H/W 5	CREDITS 4	MARKS 100
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Course Objectives

1. To introduce mathematical applications in business and management, thereby enhancing the logical thinking of the students with regard to problem solving.
2. To train the students to apply statistical techniques in business and management, thereby enhancing the decision making skills of the students.

Course Outcomes (CO)

The learners will be able to

1. Understand mathematical applications in finance.
2. Demonstrate mathematical skills like integration required in economics and business.
3. Comprehend critical thinking and problem solving skills in correlation and regression.
4. Interpret numerical information that forms the basis of index numbers in business.
5. Analyze the theoretical concepts, tools and methods of probability.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	M	L
CO2	H	H	H	H	M	L
CO3	H	H	M	H	M	L
CO4	H	H	L	H	M	H
CO5	H	M	H	H	H	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	L	H
CO4	H	H	M	L	M	H
CO5	H	H	H	L	H	H

(Low - L, Medium - M, High - H)

Course Syllabus

Unit I: Mathematics of Finance

(15 hours)

- 1.1 Mathematics of finance (K1, K2, K3, K4)
- 1.2 Simple and Compound interest (K1, K2, K3, K4)
- 1.3 Discount on bills (K1, K2, K3, K4)
- 1.4 Pay roll wages (K1, K2, K3, K4)
- 1.5 Commission (K1, K2, K3, K4)
- 1.6 Annuities (K1, K2, K3, K4)

Unit II: Integration**(15 hours)**

- 2.1 Integration, Indefinite integrals, Standard forms (K1, K2, K3, K4)
- 2.2 Integration of x^n , $\frac{1}{x}$, e^x (K1, K2, K3, K4)
- 2.3 Basic theorems on integration, Integration (K1, K2, K3, K4)
- 2.4 Integration by substitution ($ax + b$, e^{ax+b} , $f'(x)/f(x)$) (K1, K2, K3, K4)
- 2.5 Integration by partial fractions (K1, K2, K3, K4)
- 2.6 Integration by parts, Uses of Economics. (K1, K2, K3, K4)

Unit III: Correlation and Regression**(15 hours)**

- 3.1 Correlation (K1, K2, K3, K4)
- 3.2 Karl Pearson's coefficient of correlation (K1, K2, K3, K4)
- 3.3 Spearman's rank correlation (K1, K2, K3, K4)
- 3.4 Regression (K1, K2, K3, K4)
- 3.5 Simple regression equations (K1, K2, K3, K4)
- 3.6 Regression coefficients. (K1, K2, K3, K4)

Unit IV: Index Numbers**(15 hours)**

- 4.1 Various methods of construction of index numbers, Unweighted index numbers. (K1, K2, K3, K4)
- 4.2 Weighted index numbers, Quantity index numbers, Value index numbers (K1, K2, K3, K4)
- 4.3 Test of consistency of index numbers, Time reversal test, Factor reversal test (K1, K2, K3, K4)
- 4.4 Chain base and fixed base index numbers (K1, K2, K3, K4)
- 4.5 Base shifting, Consumer price index (K1, K2, K3, K4)
- 4.6 Aggregate method, Family budget method. (K1, K2, K3, K4)

Unit V: Probability**(15 hours)**

- 5.1 Permutation and Combination (K1, K2, K3, K4)
- 5.2 Trial, Event, Sample space (K1, K2, K3, K4)
- 5.3 Mutually exclusive events, Exhaustive events, Independent events (K1, K2, K3, K4)
- 5.4 Classical definition of probability, Axiomatic definition of probability (K1, K2, K3, K4)
- 5.5 Addition and multiplication theorems (without proof) (K1, K2, K3, K4)
- 5.6 Problems (K1, K2, K3, K4)

Text Books:

1. P. A. Navnitham - Business Mathematics and Statistics - Jai Publishers - Trichy 2007.
2. R. S. N. Pillai and Bagavathi - Statistics, 17th Edition, S. Chand and Company, New Delhi, 1984
3. P. R. Vittal - Business Mathematics, 1st Edition - Margham Publications, Chennai, 1995.

Reference Books:

1. Francis, Andy - Business mathematics and statistics. Cengage Learning EMEA, 2004.
2. Agarwal, B. M. - Business Mathematics & Statistics. Ane Books Pvt. Ltd., 2009.
3. Asim Kumar Manna - Business Mathematics & Statistics. McGraw Hill Education (India) Pvt. Ltd., 2018.

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – III
UCBAG20 – Operations Research I

Year: II SEM: III	Course Code: UCBAG20	Title of the Course: Operations Research I	Course Type: Theory	Course Category: Core	H/W 6	CREDITS 6	MARKS 100
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Course Objectives

1. To introduce the use of quantitative methods and techniques for effective decision making
2. To provide a detailed knowledge about mathematical, transportation and assignment models.
3. To analyse any real life system with limited constraints and depict it in a model form.
4. To examine the aspects of business and marketing with respect to operations research.

Course Outcomes (CO)

The learners will be able to

1. Understand and solve linear programming problems.
2. Identify and develop the operational research models such as graphical and simplex method.
3. Comprehend advanced linear programming problems using Big M method.
4. Construct and solve transportation models and assignment models.
5. Analyze and evaluate assignment models.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	H	L
CO2	H	M	H	M	L	H
CO3	H	M	H	H	H	L
CO4	H	H	H	H	M	L
CO5	H	H	H	H	M	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	M	M	L	L	H
CO4	H	H	M	L	M	H
CO5	H	H	M	L	M	H

(Low-L, Medium - M, High - H)

Course Syllabus

Unit I: Introduction and Mathematical Formulation

(18 hours)

1.1 Operations research: Definition (K1, K2, K3, K4)

- 1.2 Scope, Characteristics (K1, K2, K3, K4)
- 1.3 Models of operations research: Iconic (K1, K2, K3, K4)
- 1.4 Analogue, Symbolic model (K1, K2, K3, K4)
- 1.5 Linear programming (K1, K2, K3, K4)
- 1.6 Formulation. (K1, K2, K3, K4)

Unit II: Linear Programming

(18 hours)

- 2.1 Linear Programming: Graphical method (problems: part I) (K1, K2, K3, K4)
- 2.2 Graphical method (problems: part II) (K1, K2, K3, K4)
- 2.3 Graphical method (problems: part III) (K1, K2, K3, K4)
- 2.4 Regular simplex Method (problems: part I) (K1, K2, K3, K4)
- 2.5 Regular simplex Method (problems: part II) (K1, K2, K3, K4)
- 2.6 Regular simplex Method (problems: part III) (K1, K2, K3, K4)

Unit III: Linear Programming

(18 hours)

- 3.1 Linear programming: Big 'M' method (problems part I) (K1, K2, K3, K4)
- 3.2 Big 'M' method (problems part II) (K1, K2, K3, K4)
- 3.3 Big 'M' method (problems part III) (K1, K2, K3, K4)
- 3.4 Duality (problems part I) (K1, K2, K3, K4)
- 3.5 Duality (problems part II) (K1, K2, K3, K4)
- 3.6 Duality (problems part III) (K1, K2, K3, K4)

Unit IV: Transportation Model

(18 hours)

- 4.1 Transportation Problem (K1, K2, K3, K4)
- 4.2 Initial basic feasible solution using North West Corner rule (K1, K2, K3, K4)
- 4.3 Initial basic feasible solution using least cost method and Vogel's approximation method (K1, K2, K3, K4)
- 4.4 Degeneracy, Unbalanced Transportation problem (K1, K2, K3, K4)
- 4.5 Maximization problem (K1, K2, K3, K4)
- 4.6 Test of Optimality using MODI method (K1, K2, K3, K4)

Unit V: Assignment Model

(18 hours)

- 5.1 Assignment problems (K1, K2, K3, K4)
- 5.2 Minimal assignment problems (K1, K2, K3, K4)
- 5.3 Unbalanced Assignment problems (K1, K2, K3, K4)
- 5.4 Restricted Assignment problems (K1, K2, K3, K4)
- 5.5 Maximization problem in Assignment (K1, K2, K3, K4)
- 5.6 Maximization problems in Assignment Problems (K1, K2, K3, K4)

Text Books:

1. Premkumar Gupta and Hira D. S. - Introduction to Operations Research, 1st Edition – S.Chand Company Ltd., 1998.
2. Vittal P. R - Introduction to Operations Research, 1st Edition - Margham Publishers – 1999.

Reference Books:

1. Kalavathy. S - Operations Research, 2nd Edition - Vikas Publishing Ltd., 2002.

2. K. Pandian, C. Kayalvizhi - Applied Operations Research for Management, 2nd Edition, Thirumalaa Publications, 2004.

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – IV
UCBAI20 –Operations Research II

Year: II SEM: IV	Course Code: UCBAI20	Title of the Course: Operations Research - II	Course Type: Theory	Course Category: Core	H/W 6	CREDITS 6	MARKS 100
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Course Objectives

1. To improve problem solving skills of students and make them to use the skills in daily life problems
2. To improve knowledge in Sequencing Problems, Queuing theory and Network Analysis.

Course Outcomes (CO)

The learners will be able to

1. Utilize the concepts of Operation research in real life experiments and plan the Sequencing of jobs through machines.
2. Evaluate the critical path and project duration in CPM.
3. Compute the Probability of meeting the scheduled dates in PERT and compare CPM and PERT.
4. Acquire the solutions for Game of two players in Game theory.
5. Analyze the queuing theory for single channel problems.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	H	L
CO2	H	M	H	M	L	H
CO3	H	M	H	H	H	L
CO4	H	H	H	H	M	L
CO5	H	H	H	H	M	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	L	H
CO4	H	H	M	L	M	H
CO5	H	H	H	L	M	H

(Low-L, Medium - M, High - H)

Course Syllabus

Unit I: Sequencing Problems

(18 hours)

- 1.1 Introduction – Definition of Sequencing (K1, K2)
- 1.2 Basic steps – Job assigning through machines (K1, K2)
- 1.3 Processing n jobs through two machines (K1, K2, K3, K4)
- 1.4 Processing n jobs through three machines (K1, K2, K3, K4)

- 1.5 Processing two jobs through m machines (K1, K2, K3, K4)
- 1.6 Processing n jobs through m machines (K1, K2, K3, K4)

Unit II: Network Analysis: CPM Computations **(18 hours)**

- 2.1 Introduction – Network diagram representation (K1, K2)
- 2.2 Rules for constructing the network (K1, K2)
- 2.3 Numbering the events – Different time Calculation (K1, K2, K3, K4)
- 2.4 CPM representation in Tabular form (K1, K2, K3, K4)
- 2.5 Total, Independent and free float Calculations (K1, K2, K3, K4)
- 2.6 Calculation of CPM and Project duration (K1, K2, K3, K4)

Unit III: Network Analysis: PERT Computations **(18 hours)**

- 3.1 Network diagram representation (K1, K2)
- 3.2 Basic Steps in PERT (K1, K2)
- 3.3 Difference between PERT and CPM (K1, K2, K3, K4)
- 3.4 Calculation of Critical path and Project duration (K1, K2, K3, K4)
- 3.5 Probability of meeting the scheduled dates (K1, K2, K3, K4)
- 3.6 Calculation of project duration for the scheduled dates (K1, K2, K3, K4)

Unit IV: Game Theory **(18 hours)**

- 4.1 Introduction characteristic of Games- Definition (K1, K2)
- 4.2 Meaning for Saddle points (K1, K2)
- 4.3 Game without Saddle points (K1, K2, K3, K4)
- 4.4 Games without Saddle points – Mixed Strategy
- 4.5 Basic Steps -Dominance property (K1, K2)
- 4.6 Games problems using Dominance property (K1, K2, K3, K4)

Unit V: Queuing Theory **(18 hours)**

- 5.1 Introduction - Meaning – Queuing theory (K1, K2)
- 5.2 Various types of Queuing Model (K1, K2)
- 5.3 Single channel Queuing theory (infinite capacity only) (K1, K2, K3, K4)
- 5.4 Different formulae (without derivation) - Concepts
- 5.5 Calculation of Single Channel systems (K1, K2, K3, K4)
- 5.6 Problems solving using Queuing theory (K1, K2, K3, K4)

Text Books:

1. Kalavathy. S - Operations Research, 2nd Edition - Vikas Publishing Ltd., 2002.
2. Vittal P.R. - Introduction to Operations Research, 1st Edition - Margham Publishers – 1999.

Reference Books:

1. Premkumar Gupta and Hira D.S. - Introduction to Operations Research, 1st Edition – S.Chand Company Ltd., 1998.
2. K. Pandian, C.Kayalvizhi - Applied Operations Research for Management, 2nd Edition, Thirumalaa Publications, 2004

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – I
UABMA20 – Business Mathematics and Statistics

Year: I SEM: I	Course Code: UABMA20	Title of the Course: Business Mathematics and Statistics	Course Type: Theory	Course Category: Core	H/W 5	CREDITS 4	MARKS 100
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Course Objectives

1. To provide an opportunity to master mathematical applications in Economics, Finance, Commerce and Management.
2. To develop the ability of students to deal with numerical and quantitative issues in business.
3. To have a strong understanding of statistical applications in Economics and Management.
4. To enable the use of statistical techniques wherever relevant.

Course Outcomes (CO)

The learners will be able to

1. Apply the knowledge in matrices in solving business problems.
2. Analyze and demonstrate differentiation skills in economics and business.
3. Apply statistical and graphical techniques wherever relevant.
4. Apply the concepts, tools and techniques in business statistical analysis.
5. Solve a range of problems using the techniques covered.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	L
CO2	H	M	H	H	M	L
CO3	H	M	H	H	M	L
CO4	H	M	H	H	M	L
CO5	H	M	H	H	M	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	L	H
CO4	H	H	M	L	M	H
CO5	H	H	M	L	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Matrices

(15 hours)

- 1.1 Definition, Types of matrices (K1, K2, K3, K4)

- 1.2 Matrix operations, Determinant of a matrix (K1, K2, K3, K4)
- 1.3 Singular and non-singular matrices (K1, K2, K3, K4)
- 1.4 Inverse of a matrix by co-factor method (K1, K2, K3, K4)
- 1.5 Rank of a matrix (K1, K2, K3, K4)
- 1.6 Solution of system of linear simultaneous equations using Cramer's rule (K1, K2, K3, K4)

Unit II: Differentiation

(15 hours)

- 2.1 Differentiation (K1, K2, K3, K4)
- 2.2 Derivatives of standard functions x^n , e^x , $\log x$, constant (without proof) (K1, K2, K3, K4)
- 2.3 Rules of differentiation (Addition, difference, product, quotient) (K1, K2, K3, K4)
- 2.4 Chain rule, Successive differentiation (up to second derivative) (K1, K2, K3, K4)
- 2.5 Uses: Marginal Concepts, Elasticity of demand, Increasing and decreasing functions (K1, K2, K3, K4)
- 2.6 Maxima and minima, break - even point. (K1, K2, K3, K4)

Unit III: Classification and Graphical Representation

(15 hours)

- 3.1 Introduction, meaning of classification, chief characteristics of classification, objects of classification rules of classification (K1, K2, K3, K4)
- 3.2 Frequency distribution, individual observations (K1, K2, K3, K4)
- 3.3 Discrete frequency distributions continuous frequency distribution (K1, K2, K3, K4)
- 3.4 Frequency distribution, graph of frequency distribution (K1, K2, K3, K4)
- 3.5 Histogram (K1, K2, K3, K4)
- 3.6 Frequency polygon, frequency curve. (K1, K2, K3, K4)

Unit IV: Measures of Central Tendency

(15 hours)

- 4.1 Arithmetic mean (K1, K2, K3, K4)
- 4.2 Median (K1, K2, K3, K4)
- 4.3 Mode (K1, K2, K3, K4)
- 4.4 Empirical formulae, Combined and Weighted arithmetic mean (K1, K2, K3, K4)
- 4.5 Geometric mean (K1, K2, K3, K4)
- 4.6 Harmonic mean. (K1, K2, K3, K4)

Unit V: Measures of Dispersion and Skewness

(15 hours)

- 5.1 Range (K1, K2, K3, K4)
- 5.2 Quartile deviation (K1, K2, K3, K4)
- 5.3 Mean deviation (K1, K2, K3, K4)
- 5.4 Standard deviation (K1, K2, K3, K4)
- 5.5 Karl Pearson's coefficient of skewness (K1, K2, K3, K4)
- 5.6 Bowley's coefficient of skewness. (K1, K2, K3, K4)

Text Books:

1. P. A. Navnitham - Business Mathematics and Statistics - Jai Publishers - Trichy 2007.
2. R. S. N. Pillai and Bagavathi - Statistics, 17th Edition, S. Chand and Company - New Delhi, 1984.

Reference Books:

1. Francis, Andy - Business Mathematics and Statistics. Cengage Learning EMEA, 2004.

2. Agarwal, B. M. - Business Mathematics & Statistics. Ane Books Pvt Ltd, 2009.
3. Asim Kumar Manna - Business Mathematics & Statistics. McGraw Hill Education (India) Pvt. Ltd., 2018.

e-Resources:

1. www.coursera.org/
2. <https://nptel.ac.in/>
3. <https://swayam.gov.in/>

SEMESTER – II**UASOR20 – Business Statistics and Operations Research**

Year: I SEM: II	Course Code: UASOR20	Title of the Course: Business Statistics and Operations Research	Course Type: Theory	Course Category: Allied	H/W 5	CREDITS 4	MARKS 100
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Course Objectives

1. To deepen the knowledge of statistical concepts and to introduce the concepts of Operations Research.
2. To demonstrate and apply the concepts of probability and game theory.

Course Outcomes (CO)

The learners will be able to

1. Gain practical knowledge of correlation and regression.
2. Understand the basic concepts of index numbers.
3. Learn the ideas of possible outcomes.
4. Develop mathematical skills to optimize transportation and assignment problem.
5. Propose the best strategy using decision making methods under uncertainty and game theory.

CO	PSO					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	H	M	H	H	M	L
CO2	H	M	H	H	M	L
CO3	H	M	H	H	M	L
CO4	H	M	H	H	M	L
CO5	H	M	H	H	M	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	L	H
CO4	H	H	M	L	M	H
CO5	H	H	M	L	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus**Unit I: Correlation and Regression****(15 hours)**

- 1.1 Introduction (K1,K2)
- 1.2 Scatter Diagram (K1,K2,K3)

- 1.3 Karl Pearson's coefficient of correlation (K1, K2, K3, K4)
- 1.4 Spearman's Rank correlation (K1, K2, K3)
- 1.5 Methods of forming the regression equations (K1, K2, K3)
- 1.6 Properties of regression lines and coefficients. (K1, K2, K3, K4)

Unit II: Index Numbers

(15 hours)

- 2.1 Various methods of construction of index numbers (K1, K2)
- 2.2 Methods, Simple Aggregate, Weighted Aggregate (K1, K2, K3, K4)
- 2.3 Quantity Index numbers, Value Index numbers (K1, K2, K3, K4)
- 2.4 Test of consistency of index numbers, Time reversal test, Factor reversal test (K1, K2, K3, K4)
- 2.5 Base shifting (K1, K2, K3)
- 2.6 Consumer price index, Family budget method. (K1, K2, K3)

Unit III: Probability

(15 hours)

- 3.1 Permutation, Combination (K1, K2)
- 3.2 Definitions of Trial, Event, Sample space, Mutually Exclusive Cases, Exhaustive events, Independent events (K1, K2, K3)
- 3.3 Classical definition of probability (K1, K2)
- 3.4 Axiomatic Definition of probability (K1, K2)
- 3.5 Addition and multiplication theorem (without proof) (K1, K2)
- 3.6 Problems (K1, K2, K3, K4)

Unit IV: Transportation and Assignment model

(15 hours)

- 4.1 Transportation model: Initial basic feasible solution (K1, K2, K3, K4)
- 4.2 Test for Optimality (K1, K2, K3, K4)
- 4.3 MODI method (omit degeneracy) (K1, K2, K3, K4)
- 4.4 Assignment Model: Assignment problem (K1, K2, K3, K4)
- 4.5 Minimal assignment problem (K1, K2, K3, K4)
- 4.6 Hungarian method. (K1, K2, K3, K4)

Unit V: Game Theory

(15 hours)

- 5.1 Introduction (K1)
- 5.2 Meaning (K1, K2)
- 5.3 The Maximin and Minimax principles (K1, K2, K3, K4)
- 5.4 Saddle point (K1, K2, K3, K4)
- 5.5 Games without saddle points (Mixed strategies) (K1, K2, K3, K4)
- 5.6 Dominance property (Excluding graphical and LPP methods) (K1, K2, K3, K4)

Text Books:

1. P. A. Navnitham - Business Statistics and Operations Research - Jai Publishers, Trichy 2007.
2. R. S. N. Pillai and Bhagavathi - Statistics, S. Chand and Company, New Delhi, 17th Edition 1984.
3. Kalavathy. S - Operations Research, 2nd Edition - Vikas Publishing Ltd., 4th edition 2013.

Reference Books:

1. Dr. P.R. Vittal - Mathematical Statistics, Margam Publications, 2015.
2. P.K. Gupta and D.S. Hira – Problems in Operations Research, 1st Edition – Chand and Company Ltd., 1995.

3. Dr. S. P. Gupta and Dr. M.P. Gupta – Business Statistics – Sultan Chand & Sons, New Delhi, 16th edition, 2010.

E-Resources:

1. www.coursera.org/
2. <https://nptel.ac.in/>
3. <https://swayam.gov.in/>

SEMESTER – I
UAMAA20 / UBMAA20 – Allied Mathematics I

Year: I SEM: I	Course Code : UAMAA20/ UBMAA20	Title Of The Course : Allied Mathematics I	Course Type : Theory	Course Category : Allied	H/W 6	CREDITS 5	MARKS 100
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Course Objectives

1. To introduce the basic concepts of matrices
2. To improve problem solving skills in Trigonometry
3. To introduce various methods to solve equations
4. To introduce differential and integral calculus

Course Outcomes (CO)

The learners will be able to

1. Understand the basic concepts of matrices
2. Apply the theory of equations and find roots using Newton's and Horner's method.
3. Acquire problem solving skills in trigonometry.
4. Compute radius of curvature, centre of curvature, evolutes and involutes.
5. Apply the techniques of integral calculus.

CO	PSO					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	H	H	H	H	H	L
CO2	H	H	H	H	M	L
CO3	H	H	H	H	L	L
CO4	H	H	H	H	H	L
CO5	H	H	H	H	L	L

CO	PO					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	H	H	H	H	H	L
CO2	H	H	H	H	M	L
CO3	H	H	H	H	L	L
CO4	H	H	H	H	H	L
CO5	H	H	H	H	L	L

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Matrices

(18 hours)

- 1.1 Symmetric, Skew symmetric, Hermitian, Skew Hermitian (K1, K2, K3, K4)
- 1.2 Orthogonal, Unitary matrices (K1, K2, K3, K4)
- 1.3 Eigen values and Eigen vectors (K1, K2, K3, K4)
- 1.4 Cayley-Hamilton Theorem (without proof) (K1, K2, K3, K4)
- 1.5 Verification and computation of inverse (K1, K2, K3, K4)
- 1.6 Diagonalisation of a matrix (K1, K2, K3, K4)

Unit II: Theory of Equations

(18 hours)

- 2.1 Polynomial equations (K1, K2, K3, K4)
- 2.2 Irrational roots – Complex roots (K1, K2, K3, K4)
- 2.3 Reciprocal equations (K1, K2, K3, K4)
- 2.4 Descarte’s Rule of signs (K1, K2, K3, K4)
- 2.5 Approximation of roots of polynomial equation by Newton’s method (K1, K2, K3, K4)
- 2.6 Horner’s methods (K1, K2, K3, K4)

Unit III: Trigonometry

(18 hours)

- 3.1 Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ (K1, K2, K3, K4)
- 3.2 Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ (continued) (K1, K2, K3, K4)
- 3.3 Expansion of $\sin^n \theta$, $\cos^n \theta$ (K1, K2, K3, K4)
- 3.4 Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ (K1, K2, K3, K4)
- 3.5 Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ (continued) (K1, K2, K3, K4)
- 3.6 Logarithm of a complex number (K1, K2, K3, K4)

Unit IV: Differential Calculus

(18 hours)

- 4.1 Curvature (K1, K2, K3, K4)
- 4.2 Radius of curvature in Cartesian Coordinates (K1, K2, K3, K4)
- 4.3 Polar Coordinates, (K1, K2, K3, K4)
- 4.4 p-r equations (K1, K2, K3, K4)
- 4.5 Evolutes (K1, K2, K3, K4)
- 4.6 Involutives (K1, K2, K3, K4)

Unit V: Integral Calculus

(18 hours)

- 5.1 Integration by parts (K1, K2, K3, K4)
- 5.2 Bernoulli’s formula (K1, K2, K3, K4)
- 5.3 Reduction formulae $\sin^n x$ (K1, K2, K3, K4)
- 5.4 Reduction formulae $\cos^n x$ (K1, K2, K3, K4)
- 5.5 Reduction formulae $\tan^n x$, $\operatorname{cosec}^n x$ (K1, K2, K3, K4)
- 5.6 Reduction formulae $\sec^n x$, $\cot^n x$ (K1, K2, K3, K4)

Text Books:

1. S. Narayanan and others – Ancillary Mathematics – Volumes I, II, III and IV-S.Viswanathan Printers and Publishers Private Limited, 2007

Reference Books:

1. T.K.ManikavachogamPillay and others – Algebra – Volume II – S. Viswanathan Printers and Publishers Private Limited, 2006
2. T.K.ManikavachogamPillay and others – Differential Calculus - S.Viswanathan Printers and Publishers Private Limited – Volume I, 2007
3. T.K.ManikavachagomPillay and others – Integral Calculus - S.Viswanathan Printers and Publishers Private Limited - Volume II, 2007
4. P.R. Vittal - Allied Mathematics – Margham Publications - Third Edition, 2002

e-Resource:

1. <https://nptel.ac.in/>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – II
UAMAB20 – Allied Mathematics II

Year : I SEM :II	Course Code : UAMAB20	Title Of The Course : Allied Mathematics: II	Course Type : Theory	Course Category : Allied	H/W 6	CREDITS 5	MARKS 100
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Course Objectives

1. To introduce concepts of vector calculus
2. To teach methods of solving partial differential equations
3. To introduce Laplace transforms and Fourier Series

Course Outcomes (CO)

The learners will be able to

1. Understand the use of vector calculus in science and engineering.
2. Understand the applications of Green's, Gauss divergence and Stoke's Theorems.
3. Find the complete, singular and general integral of partial differential equations.
4. Understand the basic concepts of Laplace Transforms.
5. Determine the nature of the Fourier series and find its coefficients

CO	PSO					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	H	H	H	H	H	L
CO2	H	H	H	H	H	L
CO3	H	H	H	H	M	L
CO4	H	H	H	H	M	L
CO5	H	H	H	H	H	L

CO	PO					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	H	H	H	H	H	L
CO2	H	H	H	H	M	L
CO3	H	H	H	H	L	L
CO4	H	H	H	H	H	L
CO5	H	H	H	H	L	L

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Differentiation of vectors

(18 hours)

- 1.1 Scalar and vector point functions (K1, K2, K3, K4)
- 1.2 Differentiation of vectors (K1, K2, K3, K4)
- 1.3 Differential operators (K1, K2, K3, K4)
- 1.4 Directional derivatives (K1, K2, K3, K4)
- 1.5 Gradient (K1, K2, K3, K4)
- 1.6 Divergence and Curl(K1, K2, K3, K4)

Unit II: Integration of vectors

(18 hours)

- 2.1 Line Integral (K1, K2, K3, K4)
- 2.2 Surface Integral (K1, K2, K3, K4)
- 2.3 Volume Integral (K1, K2, K3, K4)
- 2.4 Green's theorem statement and application (K1, K2, K3, K4)
- 2.5 Gauss's theorem statement and application (K1, K2, K3, K4)
- 2.6 Stoke's theorem statement and application (K1, K2, K3, K4)

Unit III: Partial Differential Equations

(18 hours)

- 3.1 Formation of Partial Differential equations by eliminating arbitrary constants (K1, K2, K3, K4)
- 3.2 Formation of Partial Differential equations by eliminating arbitrary functions (K1, K2, K3, K4)
- 3.3 Solutions of standard types of first order differential equations – $f(p,q) = 0$ (K1, K2, K3, K4)
- 3.4 Solution of $f(x,p,q) = 0$; $f(y,p,q) = 0$; $f(z,p,q) = 0$ (K1, K2, K3, K4)
- 3.5 Solution of $f_1(x,p) = f_2(y,q)$ (K1, K2, K3, K4)
- 3.6 Solution of $z = px+qy+f(p,q)$ (K1, K2, K3, K4)

Unit IV: Laplace Transformations

(18 hours)

- 4.1 Definition of Laplace transforms (K1, K2, K3, K4)
- 4.2 Laplace transforms of standard functions (K1, K2, K3, K4)
- 4.3 Laplace transforms – problems (K1, K2, K3, K4)
- 4.4 Laplace transforms – problems (continued) (K1, K2, K3, K4)
- 4.5 Inverse Laplace Transforms (K1, K2, K3, K4)
- 4.6 Solving ordinary differential equations of second order with constant coefficients using Laplace transforms (K1, K2, K3, K4)

Unit V: Fourier Series

(18 hours)

- 5.1 Definition of Fourier series (K1, K2, K3, K4)
- 5.2 Fourier series –Problems (K1, K2, K3, K4)
- 5.3 Finding Fourier coefficients for a given periodic function with period 2π (K1, K2, K3, K4)
- 5.4 Odd functions (K1, K2, K3, K4)
- 5.5 Even function (K1, K2, K3, K4)
- 5.6 Half range series.(K1, K2, K3, K4)

Text Books:

- 1. S.Narayanan and others – Ancillary Mathematics – Volumes I, II, III and IV, S.Viswanathan Printers and Publishers Private Limited, 2007.

Reference Books:

- 1. P.R. Vittal - Allied Mathematics – Margham Publications - Third Edition, 2002

2. T.K.ManikavachagomPillay and others – Ancillary Mathematics Volume I and Volume II - S.Viswanathan Printers and Publishers Private Limited, 2004
3. P.Kandasamy and K.Thilagavathi - Allied Mathematics Volume I and Volume II - S.Chand and Co, New Delhi, 2004.

e-Resource:

1. <https://nptel.ac.in/>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – III
UANAA20 – Numerical Analysis I

Year: II SEM:III	Course Code: UANAA20	Title of the Course: Numerical Analysis I	Course Type: Theory	Course Category: Allied	H/W 6	CREDITS 5	MARKS 100
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Course Objectives

1. To introduce the concepts of Numerical Analysis.
2. To provide suitable and effective methods called numerical methods, for obtaining approximate representative numerical results of problems.

Course Outcomes (CO)

The learners will be able to

1. Understand the operators and their properties, form a forward and backward difference table.
2. Execute interpolation methods using forward and backward differences when the data is equally distributed.
3. Exhibit interpolation procedures using central differences when the data is equally distributed.
4. Use divided differences for interpolation when the data is unequally distributed.
5. Implement curve fitting and method of moments.

CO	PSO					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	M	H
CO4	H	H	M	L	M	H
CO5	H	H	M	L	M	H

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Finite Differences

(18 hours)

- 1.1 Forward Differences table and Backward differences table (K1,K2)
- 1.2 Differences of polynomial and factorial polynomial (K1,K2,K3)
- 1.3 Reciprocal factorial and Polynomial in Factorial Notation (K1,K2,K3)
- 1.4 Error propagation in difference table (K1, K2, K3, K4)
- 1.5 Other differences operators (K1,K2,K3,K4)
- 1.6 Summation of series (K1,K2,K3,K4)

Unit II: Interpolation

(18 hours)

- 2.1 Introduction (K1, K2)
- 2.2 Newton's Forward interpolation formula (K1, K2, K3, K4)
- 2.3 Newton's backward interpolation formula (K1, K2, K3, K4)
- 2.4 Error in polynomial interpolation (K1, K2, K3, K4)
- 2.5 Equidistant terms with one or more missing terms (K1, K2, K3, K4)
- 2.6 Introduction and Form a central difference table (K1, K2)

Unit III: Central Difference Table

(18 hours)

- 3.1 Gauss Forward Interpolation formula (K1, K2, K3, K4)
- 3.2 Gauss backward Interpolation formula (K1, K2, K3, K4)
- 3.3 Stirling's Formula (K1, K2, K3, K4)
- 3.4 Bessel's Formula (K1, K2, K3, K4)
- 3.5 Laplace – Everett's formula (K1, K2, K3, K4)
- 3.6 Relation between Bessel's and Laplace – Everett's formula (K1, K2, K3, K4)

Unit IV: Interpolation with Unequal intervals

(18 hours)

- 4.1 Properties of divided difference (K1, K2, K3)
- 4.2 Relation between divided differences and forward differences (K1, K2, K3)
- 4.3 Newton's divided difference formula (K1, K2, K3, K4)
- 4.4 Lagrange's interpolation formula and its problem (K1, K2, K3, K4)
- 4.5 Inverse interpolation and Lagrange's method (K1, K2, K3, K4)
- 4.6 Iterative method (K1, K2, K3, K4)

Unit 5: Empirical Laws and Curve Fitting

(18 hours)

- 5.1 The Linear law and Laws Reducible to linear law (K1, K2, K3)
- 5.2 Method of Group of Averages and Equations involving three constants (K1, K2, K3, K4)
- 5.3 Principles of least squares and Fitting a Straight line and Parabola (K1, K2, K3, K4)
- 5.4. Fitting the Exponential Curve and Curve $y = a^x$ (K1, K2, K3, K4)
- 5.5 Sum of squares of Residuals (K1, K2, K3, K4)
- 5.6 Method of moments (K1, K2, K3, K4)

Text Book:

1. Dr. V.N.Vedamurthy, Dr. N.Ch.S.N. Iyengar – Numerical Methods, Vikas Publishing House Pvt. Ltd., New Delhi, 1998, Reprint 2011.

Reference Books:

1. S. Kalavathy- Numerical Methods – Thomson Learning – 5, Sheton way, Singapore, 2004.
2. Dr. A. Singaravelu – Numerical Methods – Meenakshi Agency – 120, Pushpa Nagar, Medavakkam, Chennai, Revised Edition, Dec 2007.
3. S. Arumugam, A. Thangapandi Isaac, A.Somasundaram – Numerical Methods, 2nd edition – SciTech Publishing Pvt. Ltd., Chennai – Reprint Sep 2005.
4. R. Gupta – Numerical Analysis, Revised Edition – Laxmi Publishing Ltd., New Delhi, 2001.
5. S. G. Venkatachalapathy – Calculus of Finite Differences and Numerical Analysis, 1st Edition, Margham Publications, 2003.

e - Resources:

1. <https://nptel.ac.in/>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – IV
UANAB20 – Numerical Analysis II

Year:II SEM: IV	Course Code: UANAB20	Title of the Course: Numerical Analysis-II	Course Type: Theory	Course Category: Allied	H/W 6	CREDITS 5	MARKS 100
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Course Objectives

1. To familiarize the students with finding root of equations, solving systems of linear algebraic equation, numerical integration and differentiation.
2. To solve differential equation with boundary value problems.

Course Outcomes (CO)

The learners will be able to

1. Obtain numerical solutions of algebraic and transcendental equations.
2. Find numerical solutions of system of linear equations.
3. Use numerical methods to do differentiation.
4. Use numerical methods to do integration.
5. Solve ordinary differential equations using numerical methods.

CO	PSO					
	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	H	H	M	L	M	H
CO2	H	H	M	L	M	H
CO3	H	H	M	L	M	H
CO4	H	H	M	L	M	H
CO5	H	H	M	L	M	H

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Solutions of Algebraic and Transcendental Equations

(18 hours)

- 1.1 Bisection Method (K1, K2, K3, K4)
- 1.2 Iteration Method (K1, K2, K3, K4)
- 1.3 Newton Raphson Method (K1, K2, K3, K4)
- 1.4 Regular Falsi Method (K1, K2, K3, K4)
- 1.5 Horner's method (K1, K2, K3, K4)
- 1.6 Graffe's root squaring method (K1, K2, K3, K4)

Unit II: Solutions of Simultaneous Linear Algebraic Equations

(18 hours)

- 2.1 Gauss Elimination Method (K1, K2, K3, K4)
- 2.2 Gauss – Jordan Method (K1, K2, K3, K4)
- 2.3 Jacobi's Method (K1, K2, K3, K4)
- 2.4 Gauss- Seidel Method (K1, K2, K3, K4)
- 2.5 Crout's method (K1, K2, K3, K4)
- 2.6 Inverse Crout's method (K1, K2, K3, K4)

Unit III: Numerical Differentiation and Numerical Integration

(18 hours)

- 3.1 Newton's forward difference formula (K1, K2, K3, K4)
- 3.2 Newton's backward difference formula (K1, K2, K3, K4)
- 3.3 Derivatives using Stirling's formula (K1, K2, K3, K4)
- 3.4 Maxima and Minima (K1, K2, K3, K4)
- 3.5 Trapezoidal Rule, Simpson's One-Third Rule, Simpson's Three-Eight Rule (K1, K2, K3, K4)
- 3.6 Weddle's Rule and Romberg Method (K1, K2, K3, K4)

Unit IV: Numerical Solution of Ordinary Differential Equations

(18 hours)

- 4.1 Taylor's series Method for simultaneous first order and higher order differential equations (K1, K2, K3, K4)
- 4.2 Picard's method of successive approximations (K1, K2, K3, K4)
- 4.3 Picard's method for first order differential equations (K1, K2, K3, K4)
- 4.4 Picard's method for second order differential equations (K1, K2, K3, K4)
- 4.5 Euler's method and Improved Euler's method (K1, K2, K3, K4)
- 4.6 Modified Euler's method (K1, K2, K3, K4)

Unit V Numerical Solution of Ordinary Differential Equations (Continued)

(18 hours)

- 5.1 Runge – Kutta method and Higher order R-K methods (K1, K2, K3, K4)
- 5.2 Runge – Kutta methods for simultaneous first order Equations (K1, K2, K3, K4)
- 5.3 Runge – Kutta methods for simultaneous second order Equations (K1, K2, K3, K4)
- 5.4 Predictor – Corrector Method (K1, K2, K3, K4)
- 5.5 Milne's Method (K1, K2, K3, K4)
- 5.6 Adams – Bashforth Method (K1, K2, K3, K4)

Text Book:

1. Dr. V.N.Vedamurthy, Dr.N.Ch.S.N. Iyengar – Numerical Methods, Vikas Publishing House Pvt. Ltd., New Delhi, 1998, Reprint 2011.

Reference Books:

1. S.Kalavathy- Numerical Methods – Thomson Learning – 5, Sheton way, Singapore, 2004.
2. Dr.A.Singaravelu – Numerical Methods – Meenakshi Agency – 120, Pushpa Nagar,

- Medavakkam, Chennai, Revised Edition, Dec 2007.
3. S. Arumugam, A. Thangapandi Isaac, A.Somasundaram – Numerical Methods, 2nd edition, SciTech Publishing Pvt. Ltd., Chennai – Reprint Sep 2005.
 4. R. Gupta – Numerical Analysis, Revised Edition – Laxmi Publishing Ltd., New Delhi, 2001.
 5. S. G.Venkatachalapathy – Calculus of Finite Differences and Numerical Analysis, 1st Edition, Margham Publications, 2003.

e- Resources:

1. <https://nptel.ac.in/>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – III
UACAA20 – Mathematical Foundations

Year : II SEM :III	Course Code : UACAA20	Title Of The Course : Mathematical Foundations	Course Type : Theory	Course Category : Core	H/W 6	CREDITS 6	MARKS 100
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Course Objectives

1. To provide basic mathematical concepts required for computer applications.
2. To introduce the notion of relations and functions
3. To learn simple methods in algebra

Course Outcomes (CO)

The learners will be able to

1. Understand the concepts of Mathematical logic and compute the operators on Symbolic logic.
2. Acquire knowledge about relations and functions.
3. Assess real life simple problems with permutation, combination and probability.
4. Know about matrices and their types.
5. Differentiate standard trigonometric functions.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	L	H	H
CO2	H	H	H	M	L	H
CO3	M	L	H	H	H	H
CO4	M	L	H	H	H	H
CO5	H	H	M	H	H	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	M
CO2	H	H	H	M	L	M
CO3	H	H	M	M	L	H
CO4	H	H	H	M	L	M
CO5	H	H	H	M	L	M

(Low-L, Medium - M, High - H)

Course Syllabus

Unit I: Symbolic logic**(18 hours)**

- 1.1 Symbolic logic (K1, K2, K3)
- 1.2 Logical operator(K1, K2, K3)
- 1.3 Conditional and bi-conditional operators (K1, K2, K3)
- 1.4 Converse, Inverse, Contra positive (K1, K2, K3)
- 1.5 Tautology and Contradiction (K1, K2, K3, K4)
- 1.6 Algebra of Propositions (K1, K2, K3, K4)

Unit II: Relations and Functions**(18 hours)**

- 2.1 Relation (K1, K2, K3)
- 2.2 Equivalence relation (K1, K2, K3)
- 2.3 Partition, Partial order relation (K1, K2, K3, K4)
- 2.4 Functions, Inverse (K1, K2, K3, K4)
- 2.5 Composition of functions (K1, K2, K3)
- 2.6 Properties of functions (K1, K2, K3, K4)

Unit III: Algebra**(18 hours)**

- 3.1 Probability (K1, K2, K3)
- 3.2 Probability (simple problems) (K1, K2, K3, K4)
- 3.3 Permutations(K1, K2, K3, K4)
- 3.4 combinations (K1, K2, K3, K4)
- 3.5 Combinatorial arguments (K1, K2, K3, K4)
- 3.6 Boolean algebra(K1, K2, K3)

Unit IV: Matrices**(18 hours)**

- 4.1 Types of matrices (K1, K2, K3)
- 4.2 Matrix operations, Symmetric and skew symmetric, Hermitian and skew-Hermitian(K1, K2, K3)
- 4.3 Orthogonal and Unitary (K1, K2, K3, K4)
- 4.4 Rank of a matrix (K1, K2, K3, K4)
- 4.5 Solution of system of linear equations using matrices (K1, K2, K3, K4)
- 4.6 Cramer's rule (K1, K2, K3)

Unit V: Differential calculus**(18 hours)**

- 5.1 Differentiation of standard function x^n (K1, K2, K3)
- 5.2 Differentiation of standard function e^x (K1, K2, K3)
- 5.3 Differentiation of standard function $\log x$ (K1, K2, K3)
- 5.4 Differentiation of standard functions $\sin x$, $\cos x$, $\tan x$ (K1, K2, K3)
- 5.5 Chain Rule (K1, K2, K3)
- 5.6 Successive differentiation (up to second derivative) (K1, K2, K3)

Text Books:

- 1. P.R.Vittal-Mathematical Foundations-Margham Publications, Chennai, 2nd Edition – 2003.
- 2. PA.Navanitham-Business Statistics-jai publishers, Trichy-21.

Reference Books:

1. P.R. Vittal - Allied Mathematics – Margham Publications - Third Edition, 2002
2. M.K.Venkataraman - Engineering Mathematics, Volumes I and II - The National Publication Co., Madras, 1992 and 1993

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – IV
UACAB20 – Statistical Methods

Year: II SEM: IV	Course Code: UACAB20	Title of the Course: Statistical Methods	Course Type: Theory	Course Category: Core	H/W 6	CREDITS 4	MARKS 100
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Course Objectives

1. To enrich the knowledge of students on statistical methods which play a major role in computer applications
2. To demonstrate sampling techniques and to employ statistical methods of analysis to make inference

Course Outcomes (CO)

The learners will be able to

1. Analyse the statistical data using measures of central tendency and graphs.
2. Provide an overall description of a set of data using measures of dispersion.
3. Apply the concept of regression and correlation in business problems.
4. Make decisions using hypothesis testing.
5. Apply the Chi-square test for independence as well as goodness of fit.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	H	H
CO2	H	H	M	L	H	H
CO3	M	L	H	H	H	H
CO4	M	H	H	H	H	L
CO5	H	H	H	M	L	H

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	H	M	L	M	H
CO3	H	H	H	H	L	M
CO4	H	H	M	L	L	H
CO5	H	H	H	M	L	H

(Low- L, Medium - M, High - H)

Course Syllabus

Unit 1: Introduction of Statistics and Measurements of Central Tendency

(18 hours)

- 1.1 Definition of Statistics, Classification and Tabulation (K1, K2)
- 1.2 Graphical representation of numerical data (K1, K2, K3)
- 1.3 Formation of frequency distribution (K1, K2, K3)
- 1.4 Mean and its types (K1, K2, K3, K4)
- 1.5 Median and its types(K1, K2, K3, K4)
- 1.6 Mode and its types (K1, K2, K3, K4)

Unit II: Measures of Dispersion

(18 hours)

- 2.1 Basic definition of Measures of Dispersion (K1, K2)
- 2.2 Sums on range (K1, K2)
- 2.3 Sums on quartile deviation (K1, K2, K3)
- 2.4 Sums on Mean deviation about mean and median (K1, K2, K3, K4)
- 2.5 Sums on Standard deviation (K1, K2, K3, K4)
- 2.6 Sums on coefficient of Variation(K1, K2, K3, K4)

Unit III: Correlation and Regression

(18 hours)

- 3.1 Definitions of Correlation and its types (K1, K2)
- 3.2 Karl Pearson's Co-efficient of correlation (K1, K2, K3, K4)
- 3.3 Bivariate Correlation (K1, K2, K3, K4)
- 3.4 Spearman Rank Correlation (K1, K2, K3, K4)
- 3.5 Regression equations (K1, K2, K3, K4)
- 3.6 Regression Co-efficient (K1, K2, K3, K4)

Unit IV: Tests of Hypothesis

(18 hours)

- 4.1 Basic definition of hypothesis (K1, K2)
- 4.2 Test for single and difference between means (K1, K2, K3, K4)
- 4.3 Test for single standard deviation and difference standard deviation (K1, K2, K3, K4)
- 4.4 Test for small correlation coefficient (K1, K2, K3, K4)
- 4.5 Small samples-Test for single and difference between means (K1, K2, K3, K4)
- 4.6 Paired t-test (K1, K2, K3, K4)

Unit V: Chi-Square Test and Goodness of Fit

(18 hours)

- 5.1 Definitions of Chi-Square test (K1, K2)
- 5.2 Properties (K1, K2)
- 5.3 Sums on Chi-Square test (K1, K2, K3, K4)
- 5.4 Goodness of Fit (K1, K2, K3, K4)
- 5.5 Contingency table (K1, K2, K3, K4)
- 5.6 Test for Independence of Attributes (K1, K2)

Text Book:

1. P. R. Vittal and V. Malini - Statistical and Numerical Methods, 1st Edition - Margham Publications, 2002.

Reference Books:

1. P. R. Vittal-Mathematical Statistics, 1st Edition-Margham Publications, 2002.

2. S. C. Gupta and V. K. Kappor - Fundamentals of Mathematical Statistics, 3rd Edition, Sultan Chand and Sons, 2004.
3. P. Kandasamy and K. Thilagavathy - Calculus of Finite Differences and Numerical Analysis, 1st Edition - Margam Publications, 2003.

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – III
UABSA20 – Biostatistics I

Year: II SEM: III	Course Code: UABSA20	Title of the Course: Biostatistics – I	Course Type: Theory	Course Category: Allied	H/W 6	CREDITS 5	MARKS 100
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Course Objectives

1. To deepen the knowledge in various statistical concepts which play an important role in the field of biological sciences.
2. Recognize the importance data collection and its role in determining scope of inference.
3. To apply appropriate statistical methods for analyzing one or two variables.

Course Outcomes (CO)

The learners will be able to

1. Frame a relevant frequency distribution for a given biological data.
2. Determine mean, median, mode for biological data.
3. Compute measures of dispersion.
4. Understand probability concepts.
5. Gain knowledge of correlation and regression and its applications.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	L
CO2	H	H	H	H	H	L
CO3	H	H	H	H	M	L
CO4	H	H	H	H	M	L
CO5	H	H	H	H	M	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

(Low-L, Medium - M, High - H)

Course Syllabus

Unit I: Frequency Distributions

(18 hours)

- 1.1 Introduction (K1)
 - 1.2 Frequency distribution (K1, K2, K3)
 - 1.3 Univariate frequency distribution (K1, K2, K3, K4)
 - 1.4 Bivariate frequency distribution (K1, K2, K3, K4)
 - 1.5 Diagrams –Histogram – Frequency polygon – Frequency curve (K1, K2, K3, K4)
 - 1.6 Characteristics of a frequency distribution (K1, K2, K3, K4)
- (Chapter – 5: Section 5.1-5.4)

Unit II: Measures of Central Tendency and Location

(18 hours)

- 2.1 Introduction (K1)
 - 2.2 Mean, Median (K1, K2, K3, K4)
 - 2.3 Quartiles, Deciles, Percentiles and Mode (K1, K2, K3, K4)
 - 2.4 Position of averages - Selection of the Appropriate Measure of Central Tendency (K1, K2)
 - 2.5 Geometric mean (K1, K2, K3, K4)
 - 2.6 Harmonic mean. (K1, K2, K3, K4)
- (Chapter – 6: Section 6.1 – 6.9)

Unit III: Measures of Dispersion

(18 hours)

- 3.1 Introduction (K1)
 - 3.2 Range (K1, K2, K3, K4)
 - 3.3 Interquartile Range (K1, K2, K3, K4)
 - 3.4 Mean deviation (K1, K2, K3, K4)
 - 3.5 Variance and Standard deviation (K1, K2, K3, K4)
 - 3.6 Alternate methods to find Standard Deviation-Coefficient of Variation. (K1, K2, K3, K4)
- (Chapter – 7: Sections 7.1-7.7)

Unit IV: Probability

(18 hours)

- 4.1 Introduction (K1)
 - 4.2 The probability Scale (K1, K2)
 - 4.3 Measurement of Probability (K1, K2)
 - 4.4 Laws of probability for independent events (K1, K2, K3, K4)
 - 4.5 Problems on probability (K1, K2, K3, K4)
 - 4.6 Conditional probability (K1, K2, K3, K4)
- (Chapter -8: Sections 8.1-8.5)

Unit V: Linear Regression and Correlation

(18 hours)

- 5.1 Introduction (K1)
 - 5.2 Scatter diagram (K1, K2)
 - 5.3 Correlation and Regression (K1, K2)
 - 5.4 Properties of Correlation and Regression (K1, K2)
 - 5.5 Correlation Coefficient (Rank correlation coefficient) (K1, K2, K3, K4)
 - 5.6 Regression Equations. (K1, K2, K3, K4)
- (Chapter – 13: Sections 13.1 – 13.5)

Text Book:

1. P.S.S. SundarRao, J. Richard – An Introduction to Bio Statistics, 3rd Edition – Prentice Hall of India Pvt. Ltd., 2001.

Reference Books:

1. N. Gurumani – An introduction to Biostatistics, Second Edition – MJP Publishers, 2015.

2. Wayne W. Daniel, Chad L. Cross – Biostatistics, 10th Edition – Wiley India Pvt. Ltd., 2017.
3. P. Mariappan – Biostatistics, 1st Edition – Dorling Kindersley Pvt. Ltd., 2013.

e-Resources:

4. <https://nptel.ac.in>
5. www.coursera.org
6. <https://swayam.gov.in>

SEMESTER – IV
UABSB20 – Biostatistics II

Year: II	Course Code:	Title of the Course:	Course Type:	Course Category:	H/W	CREDITS	MARKS
SEM: IV	UABSB20	Biostatistics – II	Theory	Allied	6	5	100

Course Objectives

1. To deepen the knowledge in various statistical concepts which play an important role in the field of biological sciences.
2. To understand interval estimation and hypothesis testing.
3. To interpret statistical results effectively in real life problems.

Course Outcomes (CO)

The learners will be able to

1. Apply probability distributions such as Binomial, Poisson and Normal to solve real life problems.
2. Recognize the importance of data collection and its role in determining scope of inference.
3. Execute the test of hypothesis for large and small samples drawn from a normal population.
4. Perform and apply Chi-square test
5. Carry out analysis of variance using F test.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	L
CO2	H	H	H	H	M	L
CO3	H	H	H	H	M	L
CO4	H	H	H	H	M	L
CO5	H	H	H	H	M	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

(Low-L, Medium - M, High - H)

Course Syllabus

Unit I: Probability Distributions

(18 hours)

1.1 Introduction (K1)

- 1.2 Binomial distribution (K1, K2, K3, K4)
 - 1.3 Binomial frequency distribution (K1, K2, K3, K4)
 - 1.4 Poisson distribution (K1, K2, K3, K4)
 - 1.5 Poisson frequency distribution (K1, K2, K3, K4)
 - 1.6 Normal distribution. (K1, K2, K3, K4)
- (Chapter – 9: Sections 9.1-9.4)

Unit II: Sampling

(18 hours)

- 2.1 Introduction (K1)
 - 2.2 Definitions (K1)
 - 2.3 Types of Population (K1, K2, K3)
 - 2.4 Sample (K1, K2, K3, K4)
 - 2.5 Sampling variation and Bias - Non-Probability Sampling Techniques (K1, K2, K3, K4)
 - 2.6 Probability Sampling Techniques – Listing of Population - Sample size (K1, K2, K3, K4)
- (Chapter – 10: Sections 10.1-10.9)

Unit III: Tests of significance and Estimation

(18 hours)

- 3.1 Introduction (K1)
 - 3.2 Procedure for Large Samples (K1, K2)
 - 3.3 Problems based on large samples (K1, K2, K3, K4)
 - 3.4 Procedure for Small samples: Examples (K1, K2, K3, K4)
 - 3.5 Estimation: Example for Large Samples (K1, K2, K3, K4)
 - 3.6 Estimation: Examples for Small Samples. (K1, K2, K3, K4)
- (Chapter – 12: Sections 12.1-12.6)

Unit IV: The Chi Square Test

(18 hours)

- 4.1 Introduction (K1)
 - 4.2 The formula for Chi Square (K1, K2)
 - 4.3 Distribution of Chi Square (K1, K2, K3)
 - 4.4 Degrees of freedom (K1, K2, K3)
 - 4.5 Some applications of Chi Square (K1, K2, K3, K4)
 - 4.6 Misuse of Chi Square Test. (K1, K2)
- (Chapter – 14: Sections 14.1-14.5)

Unit V: Analysis of Variance

(18 hours)

- 5.1 Snedecor's F-Distribution (K1, K2, K3, K4)
 - 5.2 Analysis of Variance (K1, K2, K3, K4)
 - 5.3 One way classification - Completely Randomised Design (K1, K2, K3, K4)
 - 5.4 Two way classification - Randomised Block Design (K1, K2, K3, K4)
 - 5.5 Latin Square Design (K1, K2, K3, K4)
 - 5.6 Merits and demerits of analysis of variance (K1, K2)
- (Chapter - 13: Sections 13.19 – 13.20)

Text Books:

1. P. S. S. SundarRao, J. Richard – An Introduction to Bio Statistics, 3rd Edition – Prentice Hall of India Pvt. Ltd., 2001.
2. P. Mariappan – Biostatistics, 1st Edition – Dorling Kindersley Pvt. Ltd., 2013.

Reference Books:

1. N. Gurumani – An introduction to Biostatistics, Second Edition – MJP Publishers, 2015.
2. Wayne W. Daniel, Chad L. Cross – Biostatistics, 10th Edition – Wiley India Pvt. Ltd., 2017.

e-Resources:

1. <https://nptel.ac.in>
2. www.coursera.org
3. <https://swayam.gov.in>

SEMESTER – I
UAMST20 – Medical Statistics

Year: I SEM: I	Course Code: UAMST20	Title of The Course : Medical Statistics	Course Type: Theory	Course Category: Allied	H/W 5	Credits 5	Marks 100
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Course Objectives

1. To introduce the basic concepts of statistics.
2. To make decisions based on statistical representation related to hospital administration.

Course Outcomes (CO)

The learners will be able to

1. Solve basic mathematical problems using matrices
2. Use various differentiation techniques
3. Give graphical representation of statistical data
4. Understand the concepts related to statistics
5. Analyze problems related to statistical measures

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	H	L
CO2	H	M	H	H	H	L
CO3	H	H	H	M	H	H
CO4	H	M	H	H	H	L
CO5	H	H	M	H	L	H

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	L
CO2	H	H	H	H	H	L
CO3	H	H	H	M	H	H
CO4	H	M	H	H	H	L
CO5	H	H	M	H	L	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Matrices**(15 hours)**

- 1.1 Definition - Types of matrices (K1, K2)
- 1.2 Matrix operations - Determinant of a matrix (K1, K2, K3, K4)
- 1.3 Singular and non-singular matrices (K1, K2, K3, K4)
- 1.4 Inverse of a matrix by co-factor method (K1, K2, K3, K4)
- 1.5 Rank of a matrix (K1, K2, K3, K4)
- 1.6 Solution of system of linear simultaneous equations using Cramer's rule (K1, K2, K3, K4)

Unit II: Differentiation**(15 hours)**

- 2.1 Derivatives of standard functions x^n , e^x , $\log x$, constant (without proof) (K1, K2, K3)
- 2.2 Rules of differentiation (Addition, difference, product, quotient) (K1, K2, K3, K4)
- 2.3 chain rule, Successive differentiation (up to 2nd derivative) (K1, K2, K3, K4)
- 2.4 Uses: Marginal Concepts, Elasticity of demand (K1, K2, K3, K4)
- 2.5 Increasing and decreasing functions (K1, K2, K3, K4)
- 2.6 maxima and minima – break - even point (K1, K2, K3, K4)

Unit III: Classification and Graphical Representation**(15 hours)**

- 3.1 Introduction - meaning of classification - chief characteristics of classification (K1, K2)
- 3.2 Objects of classification - rules of classification (K1, K2)
- 3.3 Frequency distributions (K1, K2, K3, K4)
- 3.4 Cumulative frequency distribution - bivariate frequency distributions (K1, K2, K3, K4)
- 3.5 Graph of frequency distribution - histogram (K1, K2, K3, K4)
- 3.6 frequency polygon - frequency curve (K1, K2, K3, K4)

Unit IV: Measures of Central Tendency**(15 hours)**

- 4.1 Arithmetic mean (K1, K2, K3, K4)
- 4.2 Median (K1, K2, K3, K4)
- 4.3 Mode – Empirical formulae (K1, K2, K3, K4)
- 4.4 Combined and Weighted arithmetic mean (K1, K2, K3, K4)
- 4.5 Geometric mean (K1, K2, K3, K4)
- 4.6 Harmonic mean (K1, K2, K3, K4)

Unit V: Measures of Dispersion and Skewness**(15 hours)**

- 5.1 Range - quartile deviation (K1, K2, K3, K4)
- 5.2 mean deviation (K1, K2, K3, K4)
- 5.3 Standard deviation (K1, K2, K3, K4)
- 5.4 Karl Pearson's and Bowley's coefficient of Skewness (K1, K2, K3, K4)
- 5.5 Correlation (K1, K2, K3, K4)
- 5.6 Regression (K1, K2, K3, K4)

Text Books:

1. P.A. Navnitham - Business Mathematics and Statistics, Jai Publishers, Trichy, 2023.
2. R.S.N. Pillai and Bagavathi – Statistics, S. Chand and Company, New Delhi, 17th Edition

Reference Books:

1. Asim Kumar Manna - Business Mathematics & Statistics. McGraw Hill Education (India) Pvt. Ltd., 2018.
2. Statistical Methods - S.P. Gupta, Sultan Chand, 2012.
3. Francis, Andy - Business mathematics and statistics. Cengage Learning EMEA, 2004.
4. Agarwal, B. M. - Business Mathematics & Statistics. Ane Books Pvt Ltd, 2009.
5. Dr. P.R. Vittal - Mathematical Statistics, Margam Publications, 2015.

e-Resources:

1. www.coursera.org/
2. <https://nptel.ac.in/>
3. <https://swayam.gov.in/>

SEMESTER – II
UAORA20 – Operations Research

Year: I SEM: II	Course Code: UAORA20	Title Of The Course : Operations Research	Course Type : Theory	Course Category: Allied II	H/W 5	Credits 5	Marks 100
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Course Objectives

1. To introduce the techniques of solving problems in the field of industry, marketing and finance
2. To create awareness about optimization in the utility of resources

Course Outcomes (CO)

The learners will be able to

1. Understand the basic operations research concepts and solve linear programming problems.
2. Analyze real-life situation using transportation models.
3. Assign jobs to different machines using assignment models.
4. Use knowledge of Network Analysis in Hospital Administration.
5. Acquire wide knowledge in Game Theory.

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	L	H	H
CO2	H	H	H	M	L	H
CO3	M	L	H	H	H	H
CO4	M	L	H	H	H	H
CO5	H	H	M	H	H	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	M	H
CO2	H	H	H	M	L	H
CO3	M	L	H	M	L	H
CO4	M	L	H	L	M	H
CO5	H	H	M	M	L	H

(L-Low, M-Moderate, H-High)

Course Syllabus

Unit I: Introduction and Linear Programming

(15 hours)

- 1.1 Operations research
- 1.2 : Definition – Scope (K1, K2)
- 1.3 Characteristics (K1, K2)
- 1.4 Linear programming (K1,K2)
- 1.5 Formulation (K1,K2, K3)
- 1.5 Graphical method (K1, K2, K3, K4)
- 1.6 Regular simplex method (Simple Problems) (K1, K2, K3, K4)

Unit II: Transportation Model

(15 hours)

- 2.1 Transportation Problem – Introduction (K1, K2)
- 2.2 Initial basic feasible solution (North West Corner) (K1, K2, K3, K4)
- 2.3 Initial basic feasible solution (Least Cost VAM) (K1, K2, K3, K4)
- 2.4 Unbalanced Transportation problem (K1, K2, K3, K4)
- 2.5 Maximization problem (K1, K2, K3, K4)
- 2.6 Test of Optimality using MODI method (excluding Degeneracy) (K1, K2, K3, K4)

Unit III: Assignment Model

(15 hours)

- 3.1 Assignment problem – Introduction (K1, K2)
- 3.2 Minimal assignment problem - Balanced (K1, K2, K3, K4)
- 3.3 Minimal assignment problem - Unbalanced (K1, K2, K3, K4)
- 3.4 Restricted Assignment problem (K1, K2, K3, K4)
- 3.5 Maximization problem – Balanced (K1, K2, K3, K4)
- 3.6 Maximization problem – Unbalanced (K1, K2, K3, K4)

Unit IV: Network Analysis: CPM and PERT Computations

(15 hours)

- 4.1 Construction – The Network – Numbering the events (K1, K2)
- 4.2 Different time calculations – representation in tabular form (K1, K2, K3, K4)
- 4.3 Total, Independent and Free float (K1, K2, K3, K4)
- 4.4 Calculation of critical path and project duration (K1, K2, K3, K4)
- 4.5 Basic steps in PERT – Difference between CPM and PERT (K1, K2, K3, K4)
- 4.6 Calculation of critical path and project duration (K1, K2, K3, K4)

Unit V: Game Theory

(15 hours)

- 5.1 Game theory – Meaning – Saddle point (K1, K2)
- 5.2 Pure Strategy (K1, K2, K3, K4)
- 5.3 Mixed Strategy (K1, K2, K3, K4)
- 5.4 Dominance property (K1, K2, K3, K4)
- 5.5 Solving 2 x m game using graphical method (excluding L.P.P) (K1, K2, K3, K4)
- 5.6 Solving n x 2 game using graphical method (excluding L.P.P) (K1, K2, K3, K4)

Text Books:

- 1. Premkumar Gupta and Hira D.S. - Introduction to Operations Research, 1st Edition – S.Chand Company Ltd., 1998.
- 2. Vittal P.R - Introduction to Operations Research, 1st Edition - Margham Publishers – 1999.

3. V. Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan, “Resource Management Techniques” A.R. Publications, 2009.

Reference Books:

1. Kalavathy. S - Operations Research, 4th Edition, Vikas Publishing Ltd., 2013
2. K. Pandian, C.Kayalvizhi - Applied Operations Research for Management, 2nd Edition, Thirumalaa Publications, 2004
3. R.Paneerselvam - Operation Research, PHI Learning Pvt. Ltd., 2nd Edition 2006

e -Resources:

1. www.coursera.org/
2. <https://nptel.ac.in/>
3. <https://swayam.gov.in/>

SEMESTER – V / VI
UGMAAn20 - Mathematics for Competitive Examinations

Year: III	Course Code: UGMAAn20	Title of the Course: Mathematics for Competitive Examinations	Course Type: Theory	Course Category: Non-Major Elective	H/W 3	CREDITS 3	MARKS 100
SEM: V / VI							

Course Objectives

1. To revitalize the basic knowledge of mathematics and problem solving skills.
2. To enhance logical, analytical and critical thinking of learners.
3. To help the learners to acquire satisfactory competency using verbal and nonverbal reasoning
4. To help the students to prepare for various competitive examinations.

Course Outcomes (CO)

The learners will be able to

1. Gain critical thinking and numerical ability to solve problems.
2. Apply the concepts of quantitative aptitude to solve real life problems.
3. Interpret and use data represented in different forms
4. Reason out verbally and non-verbally
5. Write various competitive exams for higher studies and jobs

CO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	L
CO2	H	M	H	M	H	L
CO3	H	M	H	M	H	L
CO4	H	H	H	H	L	L
CO5	H	M	H	H	L	L

CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	M	H
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

(L-Low, M-Moderate, H-High)

Course Syllabus

UNIT I: Numerical Ability

(9 hours)

Numbers, H.C.F. & L.C.M. of Numbers, Simplification, Decimal Fractions, Square Roots & Cube Roots, Averages, Percentage, Ratio and Proportion. (K1, K2, K3, K4)

UNIT II: Numerical Ability (Continued) (9 hours)

Ages, Time and Work, Time and Distance, Profit and Loss, Simple Interest, Compound Interest, Permutation & Combination, Probability (K1, K2, K3, K4)

UNIT III: Data Interpretation (9 hours)

Tabulation, Bar Graphs, Pie Charts, Line graphs (K1, K2, K3, K4)

UNIT IV: Verbal Reasoning (9 hours)

Series, Classification, Coding - Decoding, Blood Relations, Puzzles (K1, K2, K3, K4)

UNIT V: Verbal Reasoning (Continued) (9 hours)

Direction Sense Test, Alphabet test, Ranking and Time sequence test, Statements & Arguments, Statements & Conclusions (K1, K2, K3, K4)

Text Books:

1. Dr. R. S. Aggarwal – A Modern Approach to Verbal and Non-Verbal Reasoning – Revised Edition – 2019 – S. Chand and Co.
2. Dr. R. S. Aggarwal – Quantitative Aptitude – Seventh Edition – S. Chand and Co., 2019

Reference Books:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, McGraw Education Series, 5th Edition 2019
2. Dinesh Khattar, Quantitative Aptitude for Competitive Examinations, Pearson India, Edition 2019.
3. Sarvesh K. Verma, Quantitative Aptitude Quantum CAT 2018, Arihant publication, Edition 2018.

e-Resources:

1. <https://nptel.ac.in/>
2. www.coursera.org
3. www.indiabix.com

ASSESSMENT METHODS

1. For Allied Papers

Semester Examination (100 Marks)

Time: 3 Hours

Section A – 10 x 2 = 20 marks

Answer **all** questions

10 questions (2 questions from each unit)

Section B – 5 x 7 = 35 marks

Answer **all** questions

5 questions with internal choice (1 question from each unit)

Section C – 3 x 15 = 45 marks

Answer **any three** questions

5 questions (1 question from each unit)

CA Examination (50 Marks)

Time: 1 Hour 30 Minutes

Section A – 7 x 2 = 14 marks

Answer **all** questions

7 questions

Section B – 3 x 7 = 21 marks

Answer **any three** questions

3 out of 5 questions

Section C – 1 x 15 = 15 marks

Answer **any one** question

2 questions (1 question from each unit)

For NME: Mathematics for Competitive Examinations

Semester Examination (100 Marks)

Time: 3 Hours

100 multiple choice questions (1 mark for each question)

CA Examination (50 Marks)

Time: 1 Hour 30 Minutes

50 multiple choice questions (1 mark for each question)