Course Code	Course Name	Category	L	т	Р	J	Credit	Year of Introduction
23MAL3MC	Advanced Statistics	VAC	3	0	0	0	3	2023

i) COURSE OVERVIEW

This subject aims to familiarize the students with modern business and apply statistical techniques for arriving at sound management decisions. . Course also helps in analyzing the collected and processed data with the help of statistical tools like time series analysis, and fundamentals of hypothesis testing.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Solve business problems with the help of fundamental statistical and theoretical backgrounds using parametric tests.	Apply
CO 2	Solve business problems with the help of fundamental statistical and theoretical backgrounds using non-parametric tests.	Apply
CO 3	Apply appropriate statistical procedures to compute a two- way between-subjects ANOVA	Apply
CO 4	Apply the statistical tools in business, economical and commercial areas with the help of time series.	Apply
CO 5	Apply dimensionality reduction techniques to compute the principal components of multi-dimensional data	Apply

iii) SYLLABUS

Parametric Tests-Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z- test)- one sample and two sample tests for means of small samples (t-test) - F-test for two sample standard deviations. Non-Parametric Tests-Chi-square test for single sample standard deviation - Kolmogorov - Smirnov – test for goodnessof fit - Mann – Whitney U test and Kruskal Wallis test. ANOVA – Completely Randomized Design- Randomized Complete Block Design-Factor Analysis and Conjoint Analysis. Time Series Analysis- Components of Time Series - Simple Average Method - Moving Averages Method - Least Square Method of Trend Analysis. Multivariate Analysis: Co-variance matrix – correlation matrix, multivariate normal density function, principal components – sample variation by principal components – principal components by graphs .

iv) (a) TEXT BOOKS

1. Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, New Delhi 7th Edition, 2011.

- 2. Aczel A.D. and Sounderpandian J., Complete Business Statistics, 6th edition, Tata McGraw – Hill Publishing Company Ltd., New Delhi, 2012
- 3. Pal. & Sankar, Statistics Concepts and Applications, , Prentice Hall India, 2005

(b) REFERENCES

- 1. Gupta.S.P " Statistical Methods" Sultan Chand & Sons 38th Edition 2004
- 2. Srivastava, S.C. "Fundamentals of Statistics", Sangya Srivastava Anmol Publications

Private Limited, New Delhi,2006.

3. Bruce L. Bowcman, Richard T.O. Connell and Michael L. Hand, "Business Statistics in Practice", 2nd Edition, McGraw – Hill, 2001

Module	Contents	No. of hours
I	Parametric Tests-Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z- test), one sample and two sample tests for means of small samples (t- test), F-test for two sample standard deviations.	9
11	Non-Parametric Tests-Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov – test for goodnessof fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test.	9
III	ANOVA – Completely Randomized Design, Randomized Complete Block Design, Introduction to Discriminate Analysis, Cluster Analysis, Factor Analysis and Conjoint Analysis.	9
IV	Time Series Analysis: Components of Time Series, Techniques of measuring seasonal variations – Simple Average Method, Moving Averages Method. Least Square Method of Trend Analysis, Applications of Time Series in Business Forecasting.	9
V	Multivariate Analysis: Co-variance matrix – correlation matrix, multivariate normal density function, principal components – sample variation by principal components – principal components by graphs	9
	Total hours	45

v) COURSE PLAN

(vi) ASSESSMENT PATTERN

Continuous Assessment : End Semester Examination - 40 : 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	40 marks
End Semester Examination	:	60 marks
TOTAL	:	100marks

(vii)CONTINUOUS ASSESSMENT TEST

- No. of tests: 02
- Maximum Marks: 30
- Test Duration: 1 1/2 hours
- Topics: 2 1/2 modules

(viii) END SEMESTER EXAMINATION

- Maximum Marks: 60
- Exam Duration: 3 hours

Course Code	Course Name	Category	L	т	Ρ	J	Credit	Year of Introduction
23MAL3MD	Quantitative Techniques for Decision Making	VAC	3	0	0	0	0	2023

ii) COURSE OVERVIEW

To acquaint the students with applications of operations research to business and industry. Decision-making is increasingly becoming more and more complex. This course exposes the students to the significance of various scientific tools and models that are available in operations research like Transportation Problem, Assignment Problem, PERT and CPM.

ii) COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO 1	Solve linear programming problems using graphical or simplex method.	Apply
CO 2	Solve linear programming problems using artificial variable techniques and duality theorems	Apply
CO 3	Apply the optimized material distribution schedule using transportation model to minimize total distribution cost.	Apply
CO 4	Solve assignment and travelling salesman problem using appropriate optimization techniques	Apply
CO 5	Construct an optimal sequence of jobs to be done using different machines in minimum Total Elapsed Time.	Apply

iii) SYLLABUS

Linear Programming Problem – Graphical solution-Simplex Method.Big-M method-Two-phase method-Duality in LPP-Dual Simplex Method.Transportation Problem-MODI method-Transhipment models. Assignment problem-Hungarian method-Solution of unbalanced problem-Travellingsalesman problem.Sequencing problems-Job Sequence: Basic terms used in sequencing-Processing n Jobs through Two Machines- Processing n Jobs through k machines-Processing 2 Jobs through k Machines.

iv) (a) **TEXT BOOKS**

- 1. Frederick S Hillier, Gerald J. Lieberman, Introduction to Operations Research, SeventhEdition, McGraw-Hill Higher Education, 2021.
- 2. Kanti Swarup, P. K. Gupta, Man Mohan, Operations Research, Sultan Chand Sons, NewDelhi, 2008.

(b) REFERENCES,.

- 1. Singiresu S Rao, Engineering Optimization: Theory and Practice ,New Age,International Publishers, 1996
- 2. H A Taha, Operations research : An introduction , Macmillon Publishing company,1976
- 3. B. S. Goel, S. K. Mittal, Operations research, Pragati Prakashan, 1980
- 4. S.D Sharma, "Operation Research", Kedar Nath and RamNath Meerut , 2008.
- 5. Phillips, Solberg Ravindran, Operations Research: Principles and Practice, 1991

v) COURSE PLAN

Module	Contents	No. of hours
Ι	Linear Programming – Introduction: Definition; Formulation, Graphical Solution - Simplex methods - Scope of OR in Business; Relevance of quantitative techniques in management decision making; Special cases; Sensitivity Analysis.	9
II	Artificial variable technique: Big M method, Two-phase method; Degeneracy and Unbounded solutions of LPP, Duality of LPP; Solution of LPP using principle of Duality, Dual Simplex Method.	9
III	Transportation: Initial basic feasible solution methods-North West Corner rule; Least Cost method and Vogel's approximation method -Optimality test– MODI method (Minimising and Maximising Problems) – Balanced and unbalanced Problems; Case of Degeneracy. Transhipment Models.	9
IV	Assignment problem (Minimising and Maximising Problems) – Balanced and Unbalanced Problems. Solution by Hungarian . Travelling Salesman problem.	9
V	Sequencing problems-Job Sequence: Basic terms used in sequencing-Processing n Jobs through Two Machines- Processing n Jobs through k machines-Processing 2 Jobs through k Machines	9
	Total hours	45

(vi) ASSESSMENT PATTERN

Continuous Assessment : End Semester Examination - 40 : 60

Continuous Assessment		
Attendance	:	5 marks
Assignments	:	15 marks
Assessment through Tests	:	20 marks
Total Continuous Assessment	:	40 marks
End Semester Examination	:	60 marks
TOTAL	:	100marks

(vii)CONTINUOUS ASSESSMENT TEST

- No. of tests: 02
- Maximum Marks: 30
- Test Duration: 1 1/2 hours
- Topics: 2 ¹/₂ modules

(viii) END SEMESTER EXAMINATION

- Maximum Marks: 60
- Exam Duration: 3 hours