Malaviya National Institute of Technology Jaipur
Course Code: MET 902
Course: Design of Experiments and optimization
(Proposed Syllabus)
2-0-0

Unit-I Design of Experiments

Introduction to statistical analysis, Design of experiment definition, objective, strategies, factorial design, designing engineering experiments, ANOVA, EVOP, Fractional, Full and Orthogonal Experiments, Taguchi methods for robust design, response surface methods, data validation with predicted values.

Unit-II Engineering Optimization

Engineering Optimization definition, need and application, formulation of optimization problems, new generation optimization techniques- Genetic algorithm and simulated annealing, neural network based optimization, optimization of fuzzy systems, multi-criteria decision making (MCDM)

Unit III Modelling tools and data analysis

Mathematical Model, types of Mathematical models and properties, Procedure of modeling, simulation from discrete probability distributions, computation work, use of software tools, spread sheet, generating charts, graphs and tables, application of theoretical and system modelling for respective area of problems

Text books

1. D G Montgomery, Design and analysis of Experiments, John Willy India Edition
2. Phillip Ross, Taguchi Techniques for Quality Engineering, McGraw-Hill Education
3. J R Timothy, Fuzzy Logic with Engg. Application, John Willy Publication
4. D E Goldberg, Genetic Algorithm in search, optimization and machine learning
5. E H Aartse, Simulated Annealing: Theory and application

Reference books

1. Edward A. Bender,An Introduction to Mathematical Modeling.
2. A. C. Fowler, Mathematical Models in Applied Sciences, Cambridge University Press.
3. J. N. Kapoor, Mathematical Modeling, Wiley eastern Limited.
4. S.M. Ross, Simulation, India Elsevier Publication.
5. A.M.Law and W.D.Kelton, Simulation Modeling and Analysis, T.M.H. Edition

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Course Code: BMT903

Course: Survey Research Methods

(Proposed Syllabus)
Credits 2 (2-0-0)

Unit 1:   Introduction to Research Philosophy and Survey research design

Principles of Scientific investigation, Research Quality, Research Philosophy, Components of survey research design

Unit 2:   Sampling, Measurement, and Data Collection design

Sampling Methods – probabilistic and non-probabilistic sampling methods, sample size determination

Measurement and Scaling – Levels of measurements, scaling and scaling techniques – comparative and non-comparative, scale construction

Data Collection – Primary and secondary data collection – sources, methods, techniques and issues

Unit 3:   Statistical design and methods

Preparing data for analysis, Descriptive statistics – measures of central tendency, dispersion and association

Hypothesis Testing – Process and major considerations, Parametric and non-parametric hypothesis testing

Multivariate statistical methods – Multiple Linear Regression, Logistic Regression, Discriminant Analysis, Factor Analysis, Cluster Analysis, Conjoint Analysis, Introduction to Structural Equation Modelling

Recommended Books:

1. Creswell, J.W. and Creswell, J.D. (2017) Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, Sage

2. Zikmund, W. G., Babin, B. J., Carr, J. C., Adhikari, A. and Griffin, M. (2016) Business Research Methods: A South-Asian Perspective with CourseMate, 8th Edition, Cengage

3. Cooper, D. R., Schindler, P. S. and Sharma, J. K. (2018) Business Research Methods, 12th Edition, McGraw Hill

4. Bryman, A., Bell, E. and Harley, B. (2018) Business Research Methods, 5th Edition, Oxford University Press

5. Sekaran, U. and Bougie, R. (2016) Research Methods for Business: A Skill–Building Approach, 7th Edition, Wiley

6. Saunders, M. N. K., Lewis, P. and Thornhill, A.(2019) Research Methods for Business Students, 8th Edition, Pearson

7. Bajpai, N. (2017) Business Research Methods, 2nd Edition, Pearson

8. Anderson, D.R., Sweeny, D. J., Williams, T.A., Camm, J.D. and Cochran, J.J. (2014) Statistics for Business & Economics, 12th Edition, Cengage

9. Stine, R. and Foster, D. (2014) Statistics for Business Decision Making and Analysis, 2nd Edition, Pearson Education

10. Lind, D.A., Marchal, W.G. and Wathen, S.A. (2013) Basic Statistics for Business and Economics, 7th Edition, McGraw-Hill Education

11. Bajpai, N. (2013) Business Statistics, 2nd Edition, Pearson Education India

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY

Department of Humanities and Social Sciences

1. Course Code: **HST 904**

2. Course Title: **Research Design: Inquiry and Discovery**

3. Course Hours: **L** $\boxed{2}$ **T** $\boxed{0}$ **P** $\boxed{0}$

4. Credits: $\boxed{2}$

5. Pre-requisites: Basic idea of research and exploration.

6. Course Objectives:

> - To impart comprehensive understanding of research process.
> - To create awareness regarding theoretical and methodological approaches of research.
> - To enhance capacity regarding rigor and bias throughout the research cycle.

7. Course Outcomes:

> - Demonstrate a comprehensive understanding of the different stages of research.
> - Demonstrate an awareness of the range of the theoretical and methodological approaches relevant to social science research.
> - Address issue of rigor and bias throughout the research cycle.

8. Course Contents:

> **Module 1:** *Getting Ready for Research-* Use of tools for Research: methods to search required information effectively, computer-assisted data collection, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.
>
> **Module 2:** *Research Paradigms –* Descriptive, Interpretative and Relational research, Matching research question with the research design, issues relating to research questions, the need (or not) for Hypotheses, Developing concepts, Establishing relationships between outcomes and key casual factors, connection with literature review.
>
> **Module 3:** *Framework for research and research design-* Evidence-based synthesis, building strong conceptual frameworks, Critical review of literature , Developing effective analysis and argument, use of evidence to substantiate the central claim that answer the research question
>
> **Module 4:** *Data Collection-* Exploring Data: Concept of Measurement and scaling, Primary, Secondary Data, Large data set and their extraction-use of Administrative Sources like Census, NFHS and NSSO, Establishing validity and reliability of data. Questionnaire design, Survey designs, Visual Methods, Qualitative data collection: Participant & Non-Participant Observation, Ethnography, Focus group discussions, Narrative Inquiry, Art-based methods

9. Suggested Readings:

Booth, W.C., Colomb, G. G., and Williams, J.M. (1995). The Craft of Research. Chapter 7 and 8 (pages 88 – 110).University of Chicago Press, Chicago and London

Cottrell, Stella (2011) Critical Thinking Skills: developing effective analysis and argumentation. Palgrave Macmillan.Chapters 4 and 10.

Cottrell, Stella (2011) 'Where's the proof: finding and evaluating sources of evidence' in Critical Thinking Skills:developing effective analysis and argumentation. Palgrave Macmillan. Chapter 8.

Crano, W. D., Brewer, M. B., & Lac, A. (2014). *Principles and methods of social research*. Routledge

Doing a literature search: a comprehensive guide for the social sciences, by Chris Hart, Chapters 1 and 2.

Gerring, J. (2011) Social science methodology: A Unified Framework. 2nd edition. Cambridge: Cambridge University Press. Chapters 2 and 8.

Gerring, J. (1999) What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences. Polity, 31(3) 357-393.

Goertz, G. (2006) 'Introduction', in Social science concepts: a user's guide, Chapter 1. Princeton, NJ: Princeton University Press, pp. 1-24

Hart, C. (1998) 'Writing the review', in Doing a literature review: releasing the social science research imagination,Chapter 7. London: SAGE Publications, pp. 172-206.

Outhwaite, W., & Turner, S. (Eds.). (2007). *The SAGE handbook of social science methodology*. Sage.

Weston, Anthony (1992) A rulebook for arguments. (2nd edition) Hacket Publishing Company, Indianapolis/Cambridge

Malaviya National Institute of Technology Jaipur
Course Code: CST-905
Course: Research Methodology - II
(Proposed Syllabus)

L-T-P: 2-0-0

Unit I: Data Structures and Algorithms
Review of Data Structures, and most commonly used algorithms in Computer Science and Engineering – Sorting, DFS/BFS, Pattern Searching,

Unit II: Linear Algebra
Vectors - linear vector spaces, linear independence, norms and inner products, Basis and dimension, Matrices, Matrix operations, Inverse of a matrix Orthogonalization, Properties of determinants, Eigenvalues and eigenvectors, SVD and pseudo inverse, KL or hotelling transform,

Unit III: Transforms
Signals and representation, Convolution, Frequency Transforms, Properties of Fourier Transform, DFT, DCT and FFT, Introduction to wavelets, applications in Computer Science and Engineering

Unit III: Probability and Statistics
Statistics: Introduction to statistical analysis, hypothesis testing – null and alternate, statistical tests – chi-square, ANOVA, data validation
Probability models and axioms, Bayes' rule, discrete and continuous random variables, Probability distributions: normal distribution and properties, conditional, marginal and joint probability distribution, PRNG (pseudo random number generators) - randomness tests, introduction to information theory and cryptography: an Introduction

Unit IV: Machine Learning: Linear and non-linear regression, supervised learning – neural network, binary decision diagram, SVM, k-NN, unsupervised learning – Clustering, Hidden Markov Models, Introduction to deep learning

Unit V: Case Studies in Research Domains of CSE

Books/References

1. Gilbert Strang: Linear Algebra, MIT Cambridge Press
2. Sheldon Ross: First Course in Probability, Pearson
3. Mark Girolami, Simon Rogers: First Course In Machine Learning, CRC Press
4. Anirban Das Gupta: Probability and Statistics for Machine Learning, Springer
5. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, second ed, Springer
6. Ian Goodfellow: Deeplearning, MIT Cambridge Press

Python and C languages shall be used for programming assignment