



ISLAMIC UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

Syllabus for PhD (Course Work)
Session: Autumn 2019

S. No	Course Code	Course	L-T-P	Credits
1.	MEC802C	Finite Element Analysis	3-1-0	4
2.	MEC801C	Research Methodology	3-1-0	4

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MEC802C

Finite Element Analysis

3-1-0

Introduction to Finite Element Method: Introduction to finite element method, weak formulations, variational formulations, approximation functions, weighted residual methods, virtual work principle, natural and essential boundary conditions.

One Dimensional Problems: Discretization of domain, elemental equations, connectivity of elements, interpolation functions and their properties, linear, quadratic and higher order shape functions, assembly of element equations, local and global stiffness matrix and its properties, boundary conditions, solution of equations, applications to solid mechanics, heat transfer and fluid mechanics problems, axisymmetric problems, transient problems.

Two Dimensional Problems: Single variable problems in 2-D, triangular elements, linear and higher order triangular elements, area coordinates, rectangular elements, higher order rectangular elements, natural coordinates, serendipity elements, numerical integration, master element, coordinate transformations, Jacobian matrix, evaluation of element matrices, boundary integrals, assembly of element equations, post computations, computer implementation.

Trusses: Basic truss element, plane truss, local and global coordinate systems, stress calculations, solution of practical problems.

Plane Elastic Problems: Governing equations for plane stress and plane strain, Weak formulations, finite element models for plane elastic problems, evaluation of boundary integrals.

Introduction to Extended Finite Element Method: Concepts of strong and weak discontinuities, enrichment functions, Stiffness matrix in XFEM, computer implementation.

Text Books:

1. Reddy J. N., An Introduction to Finite Element Methods, *McGraw Hill Education (India)*.

Reference Books:

1. Fish J. and Belytschko T., A First Course in Finite Elements, *John Wiley and Sons*.
2. Rao S. S., The Finite Element Method in Engineering, *Elsevier Publications*.
3. Liu G. R. and Quek S.S., The Finite Element Method; A Practical Course, *Butterworth Heinmann*.

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MEC801C

Research Methodology

3-1-0

Unit I

Research- Basic concepts, Scientific method and social sciences, Objectives and types of Research, Characteristics of good research, Language of research-concept, construct, variable proposition, hypothesis, Research Process, Research problem: selection and defining the Research problem, Research designs, Types of Research Design.

Unit II

Sampling Design, Basic concepts and steps in Sampling Design, Types of Sample Designs, Determination of Optimal sample size, Limitations of Sampling, Sampling and non-sampling errors, Data analysis: Meaning and methods- Quantitative and Qualitative analysis, Formulation of Hypothesis- criteria of a good hypothesis, Hypothesis Testing Procedure, Type I and Type II, Concept of significance and degree of freedom.

Unit III

Statistics in Research: Mean, Standard Deviation, Measures of Central Tendency, Dispersion, Skewness and Kurtosis; Theoretical distribution: Normal, Poisson and Binomial; Parametric tests: t test and z test, Chi-square and Analysis of Variance (ANOVA), Non-parametric tests; Factor Analysis-Cluster Analysis, Discriminant Analysis- Multiple Regression & Correlation- Canonical Correlation- Application of SPSS Package.

Unit IV

The Research report: Significance of report writing, Steps in writing report, Layout of the research report, Writing references and bibliography, Presentation Planning, Importance of effective presentation, Report writing using Latex, Creating reports and articles, text environment, math environment, figures and tables, camera ready preparation.

Unit V

Research ethics and IPR, Ethical issues, intellectual property rights and patent law, Commercialization, Copyright, Royalty, Trade related aspects of intellectual property rights, plagiarism, Reproducibility and Accountability.

Text Books:

- Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata McGraw Hill Publishing Company Limited, New Delhi, 2000
- Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., New York, 2000.
- C.R.Kothari, Research Methodology, Wishva Prakashan, New Delhi, 2001.
- Donald H.McBurney, Research Methods,ThomsonAsia Pvt. Ltd. Singapore, 2002.
- G.W.Ticehurst and A.J.Veal, Business Research Methods, Longman, 1999.
- Ranjit Kumar, Research Methodology, Sage Publications, London, New Delhi, 1999.
- Raymond-Alain Thie'tart, et.al., Doing Management Research, Sage Publications.
- Sabine, Landau, Brian S. Everitt: A handbook of statistical analyses using SPSS, Chapman & Hall/CRC Press LLC.
- P.C.Tripathi: A Textbook of Research Methodology in Social Sciences, Sultan Chand & Sons
- Goodle William J. Hatt Paul K.: Methods in Social Research, McGraw-Hill Book Company.
- Bhattacharyya D.K. Research Methods, Excel Books

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