Second Semester
M.Tech (Industrial Design)
MID 201: THEORY OF VIBRATION

Unit 1
Review of single degree freedom free, damped and forced vibration, isolation, Transmissibility; Two degree freedom System: Free vibrations, principal modes of vibration, various examples such as double pendulum, two rotor system torsional oscillations etc, Undamped forced vibrations with harmonic excitation, Principle of vibration absorbers, un-damped dynamic vibration absorber, tuning of vibration absorber, Torsional vibration absorber system.

Unit 2
Many degrees of freedom systems (Exact analysis): relation between discrete and continuous system, boundary value and Eigen value problems, Un-damped free vibrations. Influence numbers and Maxwell's reciprocal theorem, axial vibration of rods, bending vibration of bars, torsional vibrations of circular shaft and multi-rotor system, vibrations of geared systems, Vibrations of strings.

Unit 3
Finite element and Numerical Methods: Element stiffness matrix and equation of motion, reference system, assembly process, interpolation function, hierarchical FEM and inclusion principle, Rayleigh's method, Dunkerley's method, Stodola's method, Matrix iteration method,

Unit 4
Nonlinear Vibration: Various Examples. Perturbation method, forced vibrations with nonlinear spring forces, Jump phenomenon. Self Excited Vibrations: Elementary idea of stable and unstable oscillations, self excited vibrations caused by dry friction, various examples.

Unit 5
Random Vibration: introduction, ensemble and time averages, probability density function, autocorrelation function, Fourier transform, narrow band and wide band random process, continuous and multi-degree freedom system to random excitation.

References:
I. Grover GK; Mechanical Vibration;
2. Thomson WT; Theory of Vibration with applications; PHI
3. Ambekar; Mechanical vibrations and noise engineering; PHI
4. Dukkipati, sriniwas; Textbook of mechanical vibrations; PHI
5. Meirovitch; Leonard; Fundamentals of VIBRATION; TMH
6. Grahm Keiiy, Kudari Shashidhar K; Schaum outline Mecanical vibrations; TMH
7. Tongue Benson H; Principles of Vibration; Oxford University Press
8. Srinivas P; MECHANICL VIBRATION ANALYSIS
9. Gokhale Nitin S et al, Practical Finite Element Analysis; Finite to Infinite Pub, Pune

MID 202: PRODUCT LIFE CYCLE MANAGEMENT

UNIT 1

Product Life Cycle Management – Need for PLM, Components of PLM, Product Data and Product workflow, Drivers for Change, The PLM Strategy, Developing a PLM Strategy, A Five-step Process.

UNIT 2

Strategy Identification and Selection: Strategy Elements, Implications of Strategy Elements, Policies, Strategy Analysis, Communicating the Strategy.

UNIT 3

Change Management for PLM: Configuration management, cost of design changes, schemes for concurrent engineering, Design for manufacturing and assembly, robust design, failure mode and effect-analysis.

UNIT 4

Modeling, Current Concepts: part design, sketching, use of datum's construction features, free ovulation, pattering, copying, and modifying features, reference standards for datum specification, Standards for Engineering data exchange. Tolerance Mass Property Calculations: rapid prototyping and tooling, finite modeling and analysis, general procedure, analysis techniques,

UNIT 5

Finite Element Modeling: Applicability of FEM, Static analysis, thermal analysis, dynamic analysis.

REFERENCE BOOKS:

1. Product Lifecycle Management Paradigm for century Product Realization – John Stark, Springer-Verlag, 21st, London, 3rd printing -2006. 441 pp., ISBN: 1-85233-810-5.
2. CAD/CAM Theory and Practice - Zeid, Mc Graw Hill.- 1991.
3. Computer Integrated Design and Manufacturing, - Mark Henderson & Philip Wolfe, Bedworth Mc Graw hill inc.- 1991.
4. Part modeling Users Guide, Engineer - I998.

MID 203: COMPUTER APPLICATIONS IN DESIGN

UNIT 1

Introduction to CAD/CAM/CAE Systems: Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development-A Practical Example. Components of CAD/CAM/CAE Systems: : Hardware Components, Vector-Refresh, Stroke-Refresh, Graphics Devices, Raster Graphics Devices, Hardware configuration, Software Components, Windows-Based CAD Systems.

UNIT 2

Basic Concepts of Graphics Programming: Graphics Libraries, Coordinate Systems, Window and View port, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painter's, Algorithm, Hidden- Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System.

UNIT 3

Geometric Modeling Systems: Wireframe Modeling Systems, Surface Modeling Systems, Solid Modeling Systems, Modeling Functions, Data Structure, Euler Operators, Boolean Operations, Calculation of Volumetric Properties, Non-manifold Modeling Systems, Assembly Modeling Capabilities, Basic Functions of Assembly Modeling, Browsing an Assembly, Features of Concurrent Design, Use of Assembly models, Simplification of Assemblies, Web-Based Modeling.

UNIT 4

Representation and Manipulation of Curves: Types of Curve Equations, Hermite Curves, Bezier Curve, B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a BSpline Curve, Non-uniform Rational B-Spline (NURBS) Curve, Evaluation of a NURBS Curve, Differentiation of a NURBS Curve, Interpolation Curves, Interpolation Using a Hermite Curve, Interpolation Using a B-Spline Curve, Intersection of Curves.

Representation and Manipulation of Surfaces: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface, Differentiation of a Bezier Surface, B-Spline Surface, Evaluation of a-B-Spline Surface, Differentiation of a BSpline Surface, NURBS Surface, Interpolation Surface, Intersection of Surfaces.

UNIT 5

CAD and CAM Integration: Overview of the Discrete Part Production Cycle, Process Planning, Manual; Variant; Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems.

REFERENCE BOOKS:

1. Principles of CAD/CAM/CAE systems – Kunwoo - Lee Addison Wesley -1999
2. CAD/CAM/CIM - Radhakrishnan P. et al. - New Age International - 2008
3. CAD/CAM – Theory & Practice - Ibrahim Zeid - McGraw Hill - 1998
4. Computer Integrated Design and Manufacturing - Bedworth, Mark Henderson & Philip Wolfe, McGraw hill inc. - 1991.
5. Part Modeling Users Guide - Pro-Engineer - 1998

MID 204: SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

UNIT 1

Principles of Computer Modeling and Simulation: Monte Carlo simulation. Nature of computer-modeling and simulation. Limitations of simulation, areas of applications.

System and Environment: Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches.

UNIT 2

Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem. Statistical Models in Simulation: Discrete distributions, continuous distributions.

UNIT 3

Random Number Generation: Techniques for generating random numbers. Mid square method the mod product method. Constant multiplier technique. Additive congruential method. Linear congruential method -Tests for random numbers -The Kolmogorov-Smirnov test -the Chi-square test.

UNIT 4

Random Variable Generation: Inversion transforms technique-exponential distribution. Uniform distribution, Weibul distribution, continuous distribution, generating approximate normal variates. Erlang distribution.

Empirical Discrete Distribution: Discrete uniform -distribution Poisson distribution –geometric distribution -acceptance -rejection technique for Poisson distribution gamma distribution.

UNIT 5

Design and Evaluation of Simulation Experiments: variance reduction techniques –antithetic variables, variables-verification and validation of simulation models.

Simulation Software: Selection of simulation software, simulation packages.

REFERENCE BOOKS :

1. Discrete Event System Simulation - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984.
2. Systems Simulation - Gordan. G - Prentice Hall India Ltd -1991.
3. System Simulation With Digital Computer - Nusing Deo - Prentice Hall of India -1979.16
4. Computer Simulation and Modeling - Francis Neelamkovil - John Wilely & Sons -1987.
5. Simulation Modeling with Pascal - Rath M.Davis & Robert M O Keefe - Prentice Hall Inc. - 1989.

MID 205: QUALITY AND RELIABILITY ENGINEERING

UNIT 1

Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.

Concepts in Probability and Statistics: Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems

UNIT 2

Introduction to Probability Distributions : Normal, Poisson and Binomial distribution.

Control Charts : Variable Chart – X Bar chart, R-chart and Sigma chart. Attribute Chart : P – Chart, nP Chart, C-Chart and U – Chart.

UNIT 3

Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL.

Failure Data Analysis: Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.

UNIT 4

System Reliability: Series, parallel and mixed configuration, Block diagram concept, r- out-of-n structure solving problems using mathematical models.

Reliability Improvement and Allocation : Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.

UNIT 5

Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems

REFERENCE BOOKS:

1. Quality Planning and Analysis - Tata McGraw - Juran, J.M and Gryna, F. M.-Hill publishing Company Ltd., New Delhi, India-1982.

2. Maintainability and Reliability Handbook of Reliability Engineering and Management - Editors – Ireson. W.G. and Cooms - C.F. McGraw-Hill Book Company Inc. -1988.

3. Concepts in Reliability Engineering- Srinath L S - Affiliated East-West Press Private Limited, New Delhi, India.-1985.