CHAIR FOR COMPUTATIONAL ENGINEERING L-10

SCOPE OF TOPICS FOR UNDERGRADUATE COMPREHENSIVE EXAM

A

1. Strong and weak formulations boundary value problems - 1D example
2. Concept, algorithm and application examples of FEM
3. Concept, algorithm and application examples of FDM
4. Examples of 1D, 2D and 3D finite elements
5. Types, sources and estimation of errors in modelling and numerical analysis

B

1. Approximation and interpolation of functions
2. Solution of systems of linear algebraic equations
3. Solution of nonlinear algebraic equations
4. Algebraic eigen-problem - solution methods and applications
5. Numerical differentiation and integration of functions
6. Solution of initial value problems
7. Basics of statistics and probability theory

C

1. Cross-section forces in bar structures
2. Basic definitions and relations in mechanics of solid bodies
3. Formulation and examples of dynamic problems
4. Buckling of straight bars
5. Influence lines of static forces in bar structures
6. Basic methods of solving statically indeterminate bar structures
7. Computation of stresses in bar structures

D

1. Factors determining durability of building materials
2. Properties of basic concrete constituents and their influence on strength and other physical properties of concretes
3. Actions on structures, including traffic loads on bridges
4. Limit states of building structures: classification, safety requirements and design rules
5. Design and dimensioning rules for simple structures, e.g. foundations and frames
6. Material and structural design options for residential, industrial and public utility buildings (foundations, walls, floors, roofs)
7. Joints in steel structures
8. Design rules and reinforcement detailing for simple reinforced concrete structural elements (beams, slabs).
9. Basic structural systems for concrete, steel and composite bridges
10. Road pavement and railroad track structures
11. Technology of concrete and reinforced concrete works