II Civil Engineering
NUMERICAL ANALYSIS
Academic year 2011-2012

Exam Questions – February 2012

Item No.	*Chapter [– Sub-Chapter]:* Topic[†]
1	*Object of Numerical Analysis:* Object. Problem conditioning; condition number; examples. Algorithm stability. Conclusions on problem conditioning and algorithm stability.
2	*Computer representation of numbers:* Integers. - *Reals, floating-point representation*: Representation models (scientific; binary computer).
3	*Computer representation of number - Reals, floating-point representation:* Format structure; IEEE Formats.
4	*Computer representation of numbers:* Intrinsic Fortran functions returning format parameters (CVF).
5	*Computer representation of numbers – IEEE Formats:* Special values. Representation range (reals).
6	*Computer representation of numbers – Rounding error measure:* ULP; Machine-ε; Unit rounding error.
7	*Errors, sources and propagation:* Error; Relative error. Significant digits.
8	*Errors, sources and propagation:* Error sources. Rounding error; Truncation case. Wilkinson form of the error. Examples for base $\beta = 2$.
9	*Errors, sources and propagation – Error propagation:* Propagated error. Multiplication; Division; Function evaluation.
10	*Errors, sources and propagation – Error propagation:* Loss of signification error. Addition and subtraction. Propagation of errors in a sum.
11	*Nonlinear equations:* Method and method analysis. Order of convergence; Linear convergence.
12	*Roots of an equation f(x) = 0:* Bisection method. Secant method. Remarks on secant method.
13	*Roots of an equation f(x) = 0 – Newton method:* Method; Convergence. Error estimation. Comparison with Secant method.
14	*Fixed-Point method:* Method. Convergence: contractive mapping; Theorems. Error evaluation.
15	*Fixed-Point method:* Explicit Fixed-point procedures. Higher order Fixed-point methods.
16	*Fixed-Point method:* Geometrical interpretation. The stationary process.
17	*Fixed-Point method:* Multiple roots: Definition; Computing problems; Newton method; Modified Newton method. Determination of the multiplicity order.

Item No.	*Chapter [– Sub-Chapter]:* Topic[†]
18	*Root of a polynomial:* Polynomial evaluation; Deflation; Newton method for polynomials.
19	*Root of a polynomial:* Method algorithms: Deflation. Direct iteration in the original polynomial. Complex roots (elements); Laguerre Method. Stability of the roots.
20	*Systems of non-linear equations:* Definitions. Vector norm. Matrix norm; Matrix norm induced by vector norm; spectral radius.
21	*Systems of non-linear equations:* Fixed-point method. Convergence. Second order convergence.
22	*Systems of non-linear equations:* Explicit fixed-point procedure; Iteration with constant matrix **A** (updated). Practical iteration scheme.
23	*Systems of non-linear equations:* Newton Method; Convergence; Practical iteration scheme.
24	*Linear systems of equations:* Gauss elimination. Triangular factorization of system matrix; Pivoting in Gauss elimination.
25	*Linear systems of equations – Gauss elimination:* Number of operations in Gauss elimination. Matrix inversion, number of operations.
26	*Linear systems of equations:* LU decomposition; Solution steps; Number of operations. Direct evaluation of LU factors.
27	*Linear systems of equations – Cholesky method:* Symmetric and positive definite matrices: definition, properties. Cholesky method, number of operations.

[†] *Chapter/Sub-chapter* and Topic refer to the content taught in Course lectures & Lab classes.

January 14, 2012

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