GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Civil (Water Resources Engineering) (33)
SUBJECT NAME: NUMERICAL METHODS FOR CIVIL ENGINEERING
SUBJECT CODE: 3713301
1st Semester

Type of course: Program Elective I

Prerequisite: Engineering Mathematics

Rationale: To find solution of hydraulic structures engineering problems, a mathematical model of the problem is formed and then its closed form or numerical solution is obtained using mathematics. Thus, the knowledge of application of various mathematical tools is essential for the solution of hydraulic structural problems. The course on *Numerical Methods* equips the students with the applications of numerical and statistical methods to solve problems related to hydraulic structures.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Name of Topic	Teaching Hours	% Weightage
1	Error analysis, types of errors, accuracy & precision, stability in numerical analysis	02	05
2	2 Empirical laws and curve fitting.	04	10
3	Interpolation & extrapolation, general, interpolation formulae, numerical differentiation & integration / solution of large systems of linear equations, use of software, solution of banded equations.	09	15
4	Solution of non-linear algebraic and transcendental equations, NewtonRaphson iterative method, numerical solutions of ordinary differential equations and partial differential equations using finite difference technique, its applications to structural engineering problems.	10	20
5	Solution of Eigen value problems, iterative methods & transformation methods. Applications to Structural Dynamic problems, stress problems, buckling of columns.	06	15
6	Laplace transform methods, Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace	06	15

	equation		
7	Euler's equation - Functional dependant on first and higher order derivatives	04	10
8	Correlation and regression, Principles of least squares	04	10

Reference Books:

1. Numerical methods in Engineering - Salvadori & Baron
2. Numerical Methods in Finite Element Analysis - Bathe & Wilson
3. Advanced Mathematics - Kresysig
4. Numerical Analysis - Scarborough

Course Outcome:

After learning the course the students should be able to:

1. Solve algebraic equations,
2. Obtain numerical solution of ordinary and partial differential equations,
3. Apply integration method/s for structural analysis,
4. Carry out interpolations and curve fitting,
5. Obtain solution of eigen value problems and fourier series for structural analysis,
6. Apply iterative and transformation methods in structural engineering

List of Experiments/Tutorials:

Minimum 15 problems from above topics.

List of Open Source Software/learning website:

www.scilab.org/

http://nptel.ac.in/

http://ocw.mit.edu/