GUJARAT TECHNOLOGICAL UNIVERSITY

NUMERICAL METHODS FOR CIVIL ENGINEERING
SUBJECT CODE: 2713301
SEMESTER: I

Type of course: Breadth

Prerequisite: Engineering Mathematics

Rationale: To find solution of structural 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 structural problems. The course on *Numerical Methods* equips the students with the applications of numerical and statistical methods to solve problems related to structural engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Error analysis, types of errors, accuracy & precision, stability in numerical analysis	02	05
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, Newton-Raphson 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 equation	06	15
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.

Open Ended Problems:

Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below:

1. Real life application of Numerical Methods for solving engineering problems.
2. Developing computer codes for various Numerical Methods using open source/commercial programme.
3. Application open source/commercial software tools for solving numerical problems.

Major Equipments: --

List of Open Source Software/learning website:

www.scilab.org/

http://nptel.ac.in/

http://ocw.mit.edu/