**Department of Civil Engineering**

**National Institute of Technology, Tiruchirappalli**

**Course Code and Title:** CE 653Matrix Methods of Structural Analysis

Session : July 2018 to December 2018

Semester : I

Credits : 3

**Faculty:** Dr.C.Natarajan , [nataraj@nitt.edu](mailto:nataraj@nitt.edu), 9842453050

**Office hours:** Monday to Friday 9.00 a.m. to 5.00 p.m.

**Course objectives**:

The objective of this matrix methods of structural analysis programme is to determine the effects of external loads, settlement of supports and temperature effects on determinate and indeterminate structures by numerical methods and the concept of the sub structure iteration.

1. To introduce the classical, matrix and finite element methods of structural analysis. 2. To make students understand structural behaviour.

3. To enable students to analyze determinate and indeterminate structures by using flexibility and stiffness method.

4. To familiarize students with displacement method.

5. To expose students to analysis of structures by substructure method.

At the end of this course, a student should be able to:

1. Understand the structural behavior of determinate and indeterminate structures
2. Analyse and draw the BMD and SFD using the matrix methods such as flexibility method and stiffness method for determinate and indeterminate structures.
3. Apply the concept of substructures method for analyzing structures.

**Content Overview**

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| **Sl. No.** | **Topic** | **Approx. Sessions** |
| 1. | Introduction and review of earlier methods | 1 |
| 2 | Behavior of structures | 2 |
| 3 | Generalized measurements | 1 |
| 4 | Degrees of Freedom, constrained measurements | 2 |
| 5 | Principle of superposition, Stiffness and flexibility matrices in single, multiple co-ordinates | 5 |
| 6 | Stiffness and flexibility matrices from strain energy - | 2 |
| 7 | Betti's law and its applications | 1 |
| 8 | Transformation of element matrices to system matrices, Transformation of system vectors to element vectors | 3 |
| 9 | Flexibility method applied to statically determinate and indeterminate structures | 2 |
| 10 | Choice of redundant , Transformation of redundant | 2 |
| 11 | Internal forces due to thermal expansion and lack of fit | 2 |
| 12 | Displacement method , Internal forces due to thermal expansion and lack of fit | 2 |
| 13 | Application to indeterminate structures- continuous beams, frames and trusses | 6 |
| 14 | Comparison between stiffness and flexibility methods | 1 |
| 15 | Analysis of substructures using the stiffness method and flexibility method with tridiagonalization | 2 |
| 16 | Analysis by Iteration method - frames with prismatic members - non-prismatic members. | 2 |

**Prerequisites:**

As per Institute norms

**Textbook:**

As given in the syllabus book

**Lecture:**

Monday 9.20 a.m.to 10.10a.m. Civil Dept.

Tuesday 10.30 a.m.to 11.20a.m. Civil Dept.

Friday 11.20a.m. to 12.10 p.m. Civil Dept.

**Examinations**

* First cycle test (Stiffness and Flexibility matrices) : Fourth week of October, 2018.
* Second cycle test ( Analysis of indeterminate structures by flexibility and stiffness method ) : Fourth week of November, 2018.
* End semester examination (comprehensive with emphasis on matrix methods of structural analysis ): Second week of December, 2018
* Students have to take these cycle tests and end semester examination mandatorily as per the scheduled date and time mentioned by the faculty. If the student is unable to take one of the cycle test due to some genuine reasons, he/she should inform the teacher well in advance and one re-test will be given to them. Only for genuine reasons, re-test will be given to them. If the student is absent for the final examination, he/she will be given “X” grade even if he leaves in genuine reasons. For such students, re-exam will be conducted during the month of December 2017 and May 2018 and so on for 50 marks (3 hours duration) and mark range/grading system assigned for his/her batch will be followed.

**Homework:**

Homework will be assigned at the end of each method. Homework should be done in the class note book and will be checked by the faculty anytime. Work must be clear and legible, with sufficient detail to demonstrate competent solution on the problems. Draw the BMD and SFD for the continuous beams.

**Grade Weights:**

Homework/Assignments : 10%

First Cycle test : 20%

Second Cycle test : 20%

End semester examination : 50%

**Grades**

As per Institute norms S, A, B, C, D, E and the minimum pass mark to pass this course is assigned to be40.

**Academic honesty:**

The National Institute of Technology Tiruchirappalli rules of academic honesty apply to homework and examinations. Academic misconduct will be sanctioned as outlined therein.

Plagiarism, cheating or otherwise leveraging unfair advantage over your peers will face zero tolerance. Use of mobile phones and similar technology during examinations is strictly prohibited and will result in loss of examination and an assigned grade of zero. Students should be aware of Institute definitions for violations of academic integrity, which include cheating, fabrication, multiple submission, plagiarism, abuse of academic materials and compliance in academic dishonesty, and group work. Cheating will not be tolerated, any cheating will result in a zero for that assignment/homework and notification sent to the Dean of students.

**Behaviour in class:**

Be respectful with the rest of the class.

Be sure to be in the classroom at the start of the class and do not leave earlier.

Students are permitted to leave the classroom in between the class if the student is feeling unwell.

**Attendance:**

Students who enrolls /register to this course must have a minimum of 85% attendance inclusive of medical leave, on other duty related to academic, co-curricular activities and others etc. Thereafter, no OD or any other leave shall be considered for attendance relaxation. But, allowance in the attendance requirement may be considered only for genuine reasons like suffering from long term ill- health, surgery, sudden mishap/death of near and dear etc. which can be claimed by producing a valid medical certificate. One or two day’s sick leave shall not be considered as a medical leave. Students who secures less than 85% of attendance in this course will not be allowed to write the end semester examination and ‘V’ grade shall be awarded. He/ She must register for the next summer – term course to pass the course work.

**Student Feedback on course**:

The same students’ feedback mechanism will be followed at the end of this course as done previously.

Signature of the faculty Signature of the CC chairperson Signature of the HOD