IIT Mandi
Proposal for a New Course

Course number	: CE404
Name	: Analysis of Structures
Credit	: 3
Distribution	: *L-T-P-C* 3-0-0-3
Intended for	: UG Program
Prerequisite	: CE301: Strength of Materials and Structures/Equivalent
Mutual Exclusion	: -

1. Preamble:

Structural analysis is an essential part of the Civil Engineering curriculum. This course assesses the response of a structure subjected to the external loads. The course explains in detail how a structure can be idealized, the corresponding formulation, and its limitations. Further, this course deal with a specific focus on applying conventional theories in estimating the internal forces, reactions, and displacement of the structural system. A detailed analysis of both determinate and indeterminate structures shall be explained as part of this course. An introduction to matrix methods for structural analysis is also included. Furthermore, the students will also be encouraged to write codes in any standard programming language based on the concepts learned in this course.

2. Course Modules with quantitative lecture hours:

Module 1: Introduction: Statically determinate vs statically indeterminate structures, **(3 Hours)** Degrees of static and kinematic indeterminacy, Review on the methods of analysis of determinate structures

Module 2: Energy methods of structural analysis: Basic concept, Energy relations with **(5 Hours)** structural theory, Virtual work and its application, Energy principles based on displacement and force fields.

Module 3: Analysis using force method: Analysis of indeterminate beams and frames, **(6 Hours)** Law of reciprocal deflections, Theorem of least work, Reactions due to yielding of supports, Analysis of indeterminate trusses using force method

Module 4: Analysis using the displacement method: Slope-deflection method: **(8 Hours)** Analysis of continuous beams, analysis of rigid frames with and without side sway; Moment distribution method: Analysis of indeterminate beams subjected to loads and uneven settlement of supports, analysis of rigid frames with and without side sway.

Module 5: Three-moment theorem: Derivation and application for analysis of **(4 Hours)** continuous beams subjected to loads and supports settlement.

Module 6: Arches: Introduction, Basic mechanics, Three hinged arch, Two hinged **(5 Hours)** arch, Tied arch and bowstring girder, Analysis of cables and suspension bridges.

Module 7: Approximate analysis of statically indeterminate structures: Analysis of **(4 Hours)** trusses, Gravity loaded building frames, Portal and cantilever methods for laterally loaded building frames.

Module 8: Moving load and Influence lines: Introduction to the methodology and **(2 Hours)** application to indeterminate structures.

Module 9: Advanced concepts: Brief introduction to matrix stiffness method of **(5 Hours)** structural analysis and exposure to relevant software's, Basic introduction to plastic analysis: plastic hinge, shape factor, collapse mechanism, Methods of analysis: static and kinematic.

Laboratory/practical/tutorial Modules: -

3. Text books:

1. Hibbeler, RC, Structural Analysis, Pearson Education, 9th edition, New Delhi, 2017.
2. Reddy, C.S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2001.

4. References:

1. Wang, C.K., Intermediate Structural Analysis, Tata McGraw Hill, New Delhi, 2010.
2. Ghali, A., and Neville, A.M., Structural Analysis: A Unified Classical and Matrix Approach', 7th Edition, CRC Press, 2017.
3. Negi, LS,and Jangid, R.S., Structural Analysis, Tata Mc. Graw, New Delhi, 1997.
4. Gupta, S. P., Gupta, R, and Pandit, GS, Theory of Structures, Tata McGraw-Hill, 1999.
5. Menon, D, Advanced Structural Analysis, Narosa Publishing House, 2015.
6. Kassimali, A., Structural Analysis, 6th Edition, Cengage Learning, 2018.

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	-	-	-	-

6. Justification of new course proposal if cumulative similarity content is >30%: