DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE & Affiliated to Anna University, Chennai)
Re-Accredited by NAAC with 'A' Grade
Accredited by NBA for AERO, BME, CSE, ECE, EEE, IT & MECH.
PERAMBALUR-621212, TAMILNADU, INDIA.
Website: www.dsengg.ac.in

## COURSE PLAN

| | | | | |
|---|---|---|---|---|
| **Course Code/Name** | **U23CET61 / Structural Analysis II** | | | |
| **Year/Section/Department** | **III / - / Civil Engineering** | | | |
| **Credits Details** | **L: 3** | **T: 0** | **P: 0** | **C: 3** |
| **Total Contact Hours Required** | **45** | | | |

**Syllabus:**

| **UNIT I / INFLUENCE LINES FOR DETERMINATE STRUCTURES** | **No. of Periods: 09** |
|---|---|
| Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section Calculation of critical stress resultants due to concentrated and distributed moving loads - Influence lines for member forces in pin jointed plane frames. | |
| **UNIT II / ARCHES** | **No. of Periods: 09** |
| Types of Arches - Analysis of three hinged and two hinged arches – Parabolic and circular arches Three and two hinged arches for calculating horizontal thrust, radial shear and BM at any section | |
| **UNIT III / SPACE AND CABLE STRUCTURES** | **No. of Periods: 09** |
| Analysis of Space trusses using method of tension coefficients – Beams curved in plan Suspension cables – suspension bridges with two and three hinged stiffening girders | |
| **UNIT IV / PLASTIC ANALYSIS** | **No. of Periods: 09** |
| Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods – Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames. | |
| **UNIT V/ FINITE ELEMENT METHOD** | **No. of Periods: 09** |
| Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element Plane stress and plane strain - Triangular elements | |

**Objectives:**

- To understand the concept of analysis of indeterminate structures by various influence line method
- To analysis the different types of arches
- To analysis the different types of space and cable structures.
- To design the member using plastic analysis
- To understand the analysing concepts of finite element.

**Text Books:**

**T1:** Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4, 2014.

**T2:** Vaidyanadhan, R and Perumal, P, – "Structural Analysis Vol 1&Vol 2 Laxmi Publications Pvt. Ltd, NewDelhi, 2015.

**Websites:**

**W1:** Determinate and indeterminate structures (http://study.com/ academy/ lesson/ statically - determinate-indeterminate-structures-trusses-beams.html)

**W2:** Analysis of continuous beam (http://www.nptel.ac.in/courses/ Webcourse contents/ IIT%20Kharagpur/Structural%20Analysis/pdf/m4l27.pdf)

**W3:** www.nptel.ac.in/courses/Webcourse-contents /.../ Structural %20Analysis /pdf/m5l33.pdf

**W4:** www.nptel.ac.in/courses/Webcourse- contents/IIT%20Kharagpur/.../pdf/m3l14.pdf

**Online Mode of Study:**

- https://archive.nptel.ac.in/courses/105/101/10510105/
- https://archive.nptel.ac.in/courses/105/105/105105166/

**Course Plan:**

| Topic Number | Topic | Reference Detail | Page Number | Mode of teaching | Number of Periods Required | Cumulative Period |
|---|---|---|---|---|---|---|
| **UNIT I - INFLUENCE LINES FOR DETERMINATE STRUCTURES** | | | | | | |
| 1 | Introduction to moving loads, Concept of Influence Lines | T2-V2 | 48 | BB | 1 | 1 |
| 2 | Influence lines for reactions in statically determinate structures | T2-V2 | 49-53 | BB | 2 | 3 |
| 3 | Influence lines for shear force and bending moment in beam section | T2-V2 | 53-60 | BB | 2 | 5 |
| 4 | Calculation of critical stress resultants due to concentrated and distributed moving loads | T2-V2 | 61-69 | BB | 1 | 6 |
| 5 | Calculation of critical stress resultants due to concentrated and distributed moving loads | T2-V2 | 70-80 | BB | 1 | 7 |
| 6 | Influence lines for member forces in pin jointed plane frames. | T2-V2 | 81-90 | BB | 2 | 9 |
| **Outcome of Unit I:**<br>**CO1:** Analyse the influence lines for determinate structure | | | | | | |
| **UNIT II - ARCHES** | | | | | | |
| 7 | Arches and Types | T2, V2 | 135-140 | BB | 1 | 10 |
| 8 | Analysis of Three Hinged parabolic Arch | T2, V2 | 140-153 | BB | 2 | 12 |
| 9 | Analysis of Circular Arch springing at same level | T2, V2 | 153-157 | BB | 2 | 14 |
| 10 | Analysis of Circular Arch springing at different level | T2, V2 | 157-167 | BB | 2 | 16 |
| 11 | Analysis of Two Hinged Arch | T2, V2 | 180-192 | BB | 2 | 18 |

**Outcome of Unit II:**
**CO2:** Analyse the different types of arches.

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| **UNIT III - SPACE AND CABLE STRUCTURES** | | | | | | |
| 12 | Analysis of Space trusses using method of tension coefficients | T2-V2 | 271-276 | BB | 1 | 19 |
| 13 | Analysis of Space trusses using method of tension coefficients | T2-V2 | 271-276 | BB | 1 | 20 |
| 14 | Beams curved in plan Suspension cables | T2-V2 | 209-213 | BB | 2 | 22 |
| 15 | Beams curved in plan Suspension cables | T2-V2 | 209-213 | BB | 1 | 23 |
| 16 | Suspension bridges with two hinged stiffening girders | T2-V2 | 245-247 | BB | 2 | 25 |
| 17 | Suspension bridges with three hinged stiffening girders | T2-V2 | 228-238 | BB | 2 | 27 |

**Outcome of Unit III:**
**CO3:** Analyse the suspension bridges with stiffening girders

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| **UNIT IV – PLASTIC ANALYSIS** | | | | | | |
| 18 | Plastic theory | T2-V2 | 302-305 | BB | 1 | 28 |
| 19 | Shape factor and Load factor & Plastic hinge | T2-V2 | 305-321 | BB | 2 | 30 |
| 20 | Plastic Mechanism | T2-V2 | 321-324 | BB | 1 | 31 |
| 21 | Collapse load, its theorem & methods of plastic analysis | T2-V2 | 325-326 | BB | 1 | 32 |
| 22 | Plasticanalysis of indeterminate beams | T2-V2 | 326-340<br>518-534 | BB | 2 | 34 |
| 23 | Plasticanalysis of indeterminate frames | T2-V2 | 340-355<br>534-540 | BB | 2 | 36 |

**Outcome of Unit IV:**
**CO4:** Calculate plastic analysis with different members.

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| **UNIT V - FINITE ELEMENT METHOD** | | | | | | |
| 24 | Introduction | T2-V2 | 452,453 | BB | 1 | 37 |

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|---|---|---|---|---|---|---|
| 25 | Discretisation of a structure | T2-V2 | 454-456 | BB | 1 | 38 |
| 26 | Displacement functions | T2-V2 | 490-492 | BB | 1 | 39 |
| 27 | Truss element | T2-V2 | 464-472 | BB | 1 | 40 |
| 28 | Beam element | T2-V2 | 457-464 | BB | 2 | 42 |
| 29 | Plane stress and plane strain | T2-V2 | 475-481 | BB | 1 | 43 |
| 30 | Triangular elements | T2-V2 | 482-490 | BB | 2 | 45 |

**Outcome of Unit V:**
**CO5:** Analyse the different types of elements using finite element method.
**CO6:** Analyse the beams and trusses by various methods.

**Course Outcome:**

At the end of course: Students should be able to do:
**CO1:** Analyse the influence lines for determinate structure
**CO2:** Analyse the different types of arches.
**CO3:** Analyse the suspension bridges with stiffening girders
**CO4:** Calculate plastic analysis with different members.
**CO5:** Analyse the different types of elements using finite element method.
**CO6:** Analyse the beams and trusses by various methods.
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**Course Outcome Vs Program Outcome Mapping:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| **CO6** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |
| **AVG** | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 3 |

**Content beyond Syllabus**:

- ❖ Cables and suspension bridges
- ❖ Influence line method

**Internal Evaluation Components:**

| Webportal | Assignment | Components | Topic Number with Topic / Unit Details | Relevance to CO |
|---|---|---|---|---|
| Webportal 1 | -- | Assessment – I (60) | Unit I and II | CO 1 & CO 2 |
| | 1 | Assignment – Hand written (20) | Unit I and II | CO 1 & CO 2 |
| | 2 | Assignment – Poster Presentation / PPT (20) | Unit I and II | CO 1 & CO 2 |
| Webportal 2 | -- | Assessment – II (60) | Unit III and IV | CO 3 & CO 4 |
| | 3 | Seminar (20) | Unit III | CO 3 |
| | 4 | Case Study Report (20) | Unit IV | CO 4 |
| Webportal 3 | -- | Model Exam (75) | Unit I to V | CO 1 to CO 6 |
| | 5 | MCQ (15) | Unit I to V | CO 1 to CO 6 |
| | - | Course Attendance (10) | -- | -- |

**Submission Details:**

| Phase 1(Before AT 1) | | Phase 2 (Before AT 2) | | Phase 3 (Model) |
|---|---|---|---|---|
| Assignment 1 | Assignment 2 | Assignment 3 | Assignment 4 | Assignment 5 |
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**Google Class Code Details:**

Class Name:

**PLAN OF ASSESSMENT TEST –DISTRIBUTION OF MARKS:**

| TEST | CO- MARK WISE DISTRIBUTION | | | | | | BLOOM'S LEVEL MARK WISE DISTRIBUTION | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AT-1 | CO1 | | | | CO5 | CO6 | BTL1 | | BTL3 | | | |
| | | | | | | | | | | | | |
| AT-2 | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | BTL1 | BTL2 | BTL3 | BTL4 | BTL5 | BTL6 |
| | | | | | | | | | | | | |
| MODEL | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | BTL1 | BTL2 | BTL3 | BTL4 | BTL5 | BTL6 |
| | | | | | | | | | | | | |