**B.TECH DEGREE PROGRAMME**

**FIFTH SEMESTER**

**(2020 ADMISSIONS)**

**SYLLABUS**

Rajagiri Valley, Kakkanad,

Kochi 682 039, Kerala, INDIA

[www.rajagiritech.ac.in](http://www.rajagiritech.ac.in)



| **COURSE CODE** | **COURSE**  **NAME** | **L T P** | **CREDITYEAR**  **OF INTRODUCTION** |
| --- | --- | --- | --- |
| 100007/CE500A | STRUCTURALANALYSIS - I | 3 1 0 | 4 2020 |

**1. Preamble**

The course enables the students to analyse various types of simple structures using appropriate methods and tools. It introduces the applications of principles of mechanics of solids to determine stress resultants in statically determinate and indeterminate structures. Specific cases of cables, suspension bridges and arches are also discussed at length. The course trains the students to develop mathematical models and helps to sharpen their analytical skills. After this course students will be able to analyse structures subjected to moving loads as well**.**

**2. Prerequisite**

100007/CE300B Mechanics of Solids

**3. Syllabus**

**Module 1:**

Statically determinate trusses: Method of joints and method of sections (simple illustrative numerical problems only)

Deflection of statically determinate structures: Introduction and simple illustrative examples of simple beams and cantilever beams only on: a) Castigliano’s theorem Part I (derivation included) b) Moment area method and c) Method of successive integrations,

**Module 2:**

Principle of virtual work, Betti’s theorem, Maxwell’s law of reciprocal deflections; Unit load method for determination of deflection of statically determinate beams and trusses (simple illustrative numerical problems only)

**Analysis of Statically Indeterminate Structures:**

Degree of static and kinematic indeterminacies; Introduction to force and displacement methods.

Method of consistent deformations: Analysis of beams (simple problems with one redundant, illustration only for two-redundant problems). Concepts of effect of pre-strain, lack of fit, temperature changes and support settlement. (No numerical problems) – 4hrs.

Castigliano’s theorem Part II(Derivation required), theorem of least work. Minimum strain energy method for analysing statically indeterminate structures (Illustrative simple examples only)

**Module 3:**

**Slope Deflection Method**: Analysis of continuous beams and portal frames without sway; Frames with sway (illustration only); Settlement effects (illustration only)

**Moment Distribution Method**: Analysis of continuous beams and portal frames without sway; Frames with sway (illustration only)

**Kani’s Method**: Analysis of continuous beams and portal frames without sway; Frames with sway (illustration only)

**Module 4:**

**Cables**: Analysis of forces in cables under concentrated and uniformly distributed loads; Anchor Cable supports

**Suspension Bridges**: Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers

**Module 5:**

**Arches:** Theory of arches – Eddy’s theorem; Analysis of three-hinged arches; Normal thrust and radial shear due to simple cases of loading.

**Moving loads and influence lines**: Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams – analysis for single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than the span – conditions for maximum bending moment and shear force

**4. Text Books**

1. Gere and Timoshenko, *Mechanics of materials*, CBSPublishers

2. Kenneth Leet, Chia M Uang & Anne M Gilbert, *Fundamentals of Structural Analysis*, McGraw Hill

3. R.Vaidyanathan and P.Perumal, *Comprehensive Structural Analysis Volume I & II*, Laxmi Publications (P)Ltd

**5. Reference Books**

1 Wang C.K., Intermediate Structural Analysis, McGrawHill

2.Aslam Kassimali., Structural Analysis, CenageLearning

3.Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes Dee Publishing Pvt Ltd.,Chennai,TamilNadu.

4.Devdas Menon, Structural Analysis, NarosaPublications

5.Hibbeler., Structural Analysis, PearsonEducation

6.Kinney S., Indeterminate Structural Analysis, Oxford &IBH

7.M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice HallIndia 8.Reddy C.S., Indeterminate Structural Analysis, Tata McGrawHill

9.Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill 10.Daniel L Schodak, Structures, Pearson Education, 7e,2014

11.Negi L. S. and Jangid R. S, Structural Analysis, Tata McGraw Hill, 1997

12.Rajasekaran S. and Sankarasubramanian G., Computational Structural Mechanics, PHI, 2008 13.S.S. Bhavikatti, Structural Analysis II, Vikas Publication Houses (P) Ltd, 2016 14.Utku S, Norris C. H & Wilbur J. B, Elementary Structural Analysis, McGraw Hill, 1990 **6. Course Outcomes**

**After the completion of the course the student will be able to**

**CO1**: Apply the principles of solid mechanics to analyse trusses.

**CO2**: Apply various methods to determine deflections in statically determinate structures. **CO3**: Identify the problems with static indeterminacy and tackling such problems by means of the method of consistent deformations and energy principles.

**CO4**: Apply specific methods such as slope deflection and moment distribution methods of structural analysis for typical structures with different characteristics.

**CO5**: Apply suitable methods of analysis for various types of structures including cables, suspension bridges and arches.

**CO6**: Analyse the effects of moving loads on structures using influence lines.

**7. Mapping of Course Outcomes with Program Outcomes**

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 PO11 | PO12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1  CO2 | 2  2 | 2  2 |  |  |  |  |  |  |  |  |  |
| CO3 | 3 | 3 |  |  |  |  |  |  |  |  |  |
| CO4 | 3 | 2 |  |  |  |  |  |  |  |  |  |



| CO5 | 3 | 2 |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO6 | 3 | 2 |  |  |  |  |  |  |  |  |  |

**8. Assessment Pattern**

| **Learning**  **Objectives** | **Continuous Internal Evaluation (CIE)** | **End Semester**  **Examination**  **(ESE out of 100)** |
| --- | --- | --- |
| **Internal**  **Internal**  **Examination 1(50)**  **Examination 2(50)** |
| Remember | 10 5 | 10 |
| Understand | 20 10 | 20 |
| Apply | 30 25 | 50 |
| Analyse | 10 10 | 20 |
| Evaluate |  |  |

**9.Mark Distribution**

| **Total** | **CIE** | | | **ESE** |
| --- | --- | --- | --- | --- |
| **Attendance** | **Internal**  **Examination** | **Assignment/Quiz/**  **Total**  **Course Project** |
| 150 | 10 | 25(Average of two scores) | 15 50 | 100 |

**10. End Semester Examination Pattern**

There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question carries 14 marks and can have maximum 2 sub-divisions.

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