International Institute of Information Technology, Hyderabad  
School of Multi-disciplinary Computing  

**M.Tech in Computer Aided Structural Engineering**

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</table>
1. Vision and Mission for the School of Multi-disciplinary Computing

Vision

To be recognized as a globally reputed school by offering innovative academic programs and specializations in core computing, computing technologies, and computing in association with multiple disciplines, at all levels (UG, PG, Ph.D.) with state-of-the-art curricula, by promoting quality research in thrust areas, and blending research outcomes into teaching programs.

Mission Statements

**MS1**: To produce competent next-generation technology leaders, who can apply the science and engineering of computing to add immense value to their profession.

**MS2**: To implement a state-of-the-art curriculum in all the academic programs in line with the multidisciplinary societal and technological needs and encourage students to imbibe creativity, research, problem-solving skills, professional ethics, and human values.

**MS3**: To design and execute innovative multidisciplinary academic programs, specializations, and courses that combine computing and other domains organically, by involving all the stakeholders such as students, teachers, research scholars, experts from industry, academia, and alumni.

**MS4**: To conduct quality research in fundamental, applied, multidisciplinary, and futuristic domains and become a key player in the educational ecosystem within the country and abroad.

**MS5**: To create and sustain a strong suite of academic outreach programs catering to varied segments such as industry professionals, external students, and early career researchers.

**MS6**: To collaborate with other reputed institutions in India and abroad and implement best practices to achieve excellence.
2. PEOs, POs, and PSOs for the M.Tech Program in Computer Aided Structural Engineering

Program Educational Objectives (PEOs)

After completing this program successfully, the graduates will be able to:

PEO 1: Demonstrate critical thinking and problem-solving abilities to handle the real-world problems by transforming theoretical knowledge to design practice

PEO 2: Demonstrate the requisite breadth and depth of knowledge in advanced areas of Structural Engineering to excel in Construction/Design industry, and develop motivation to pursue research in critical areas in Structural Engineering for an academic career

PEO 3: Exhibit inter-personal skills required to function effectively in varied, dynamic, and inter-disciplinary teams

PEO 4: Demonstrate the keenness for peer learning and teamwork and lead technological advances in Structural Engineering Industry and Design Practice

PEO 5: Practice ethics and human values in their profession.

<table>
<thead>
<tr>
<th>Mapping between PEOs and Mission Statements</th>
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<tbody>
<tr>
<td>PEO vs MS</td>
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<tr>
<td>-----------</td>
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<tr>
<td>PEO1</td>
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<tr>
<td>PEO2</td>
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<tr>
<td>PEO3</td>
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<tr>
<td>PEO4</td>
</tr>
<tr>
<td>PEO5</td>
</tr>
</tbody>
</table>
Program Outcomes (POs)

After completion of M.Tech in Civil Engineering, the Postgraduates will be able to

**PO1: Engineering Knowledge:** Use concepts from Structural Engineering, Computer Science, Mathematics, and Earth Sciences, to provide design solutions

**PO2: Design:** Identify and use the necessary Structural Engineering concepts to arrive at a safe built environment.

**PO3: Modern tool usage:** Demonstrate hands-on skills to work with various software packages used in Structural Engineering Industry, and apply appropriate techniques, resources, and modern tools to model and predict complex engineering problems, with an understanding of the limitations of the tools

**PO4: Project management:** Apply the principles of project management in Structural Engineering, with focus on life cycle and costing

**PO5: Collaboration with Peers:** Work efficiently in individual and team-oriented, recognize its positive influence in professional accomplishments, and actively engage in collaboration and teamwork to execute complex structural engineering tasks

**PO6: Environment and sustainability:** Develop sustainable technological solutions to Structural Engineering problems by considering the environmental impact

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice

**PO8:** Self-learning & Life-long Learning: Develop independent responsibility to set goals, plan, initiate, monitor, and evaluate outcomes of learning to enable necessary continuity in self-development, education, and work life

**PO9:** Communication Skills: Acquire skills to communicate written and oral content effectively and competently across audiences, purposes, and settings

**PO10:** Fact-finding Skills: Develop ability to think independently to analyze, design, conduct experiments, towards value addition to state-of-practice.
Program Specific Outcomes (PSOs)

**PSO 1:** Acquire [delete] Demonstrate flexibility and freedom for a better understanding of structural behavior with material and geometric nonlinearity and loading uncertainties

**PSO 2:** Demonstrate comprehensive knowledge of computer science areas such as programming, databases, graphics, and visualization in structural engineering

**PSO 3:** Exhibit knowledge and skills to include recent advances in the development and use of computational methods for the solution of scientific and engineering problems related to structures

**PSO 4:** Apply the knowledge and skills acquired during the program towards solving complex problems national policy development [delete] in crucial areas of Structural & Earthquake Engineering
Curriculum

Computer Aided Structural Engineering is an innovative program, focused on the combination of recent advances made in the field of structural engineering and computer science. This combination allows structural engineer the flexibility and freedom for a better understanding of structural behaviour with material and geometric nonlinearity and loading uncertainties. The students join this program with a background in civil engineering. The course provides an excellent grounding in the fundamentals of structural engineering subjects. It also engages in a comprehensive study of computer science subjects such as programming, databases, graphics, visualization etc. The objective of M.Tech CASE program is to include recent advances in the development and use of computer methods for the solution of scientific and engineering problems related to structures.

The objectives of the curriculum, while maintaining the rigour of the program are:

- to keep students abreast with the latest in Structural Engineering
- to improve mathematics skills of students;
- to introduce to students use of latest technology in structural engineering field;
- to familiarise students with the properties and behaviour of new and emerging materials used in construction; and
- to benefit domain as well as non-domain students through the program

**Semester wise plan**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Structural Dynamics</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Computer Problem Solving</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>FEM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Structural Engineering Design Studio</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Theory of Elasticity</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>Sem1 Total Credits</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td>2</td>
<td>Computing Tools</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Elective I</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Elective II</td>
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<td></td>
<td>Elective III</td>
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<tr>
<td></td>
<td>Elective IV</td>
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<tr>
<td></td>
<td><strong>Sem2 Total Credits</strong></td>
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<tr>
<td>3</td>
<td>IoT Workshop</td>
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<tr>
<td></td>
<td>Elective V</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Elective VI</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Elective VIII (half-course)</td>
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<td></td>
<td><strong>Sem3 Total Credits</strong></td>
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<td>4</td>
<td>Project (Full sem)</td>
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</tr>
</tbody>
</table>
List of Electives

<table>
<thead>
<tr>
<th>Structural Engineering (SE)</th>
<th>Others (Civil Engineering)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake Resistant Design</td>
<td>Spatial Informatics</td>
</tr>
<tr>
<td>Advanced Structural Analysis</td>
<td>Building Automation</td>
</tr>
<tr>
<td>Stability of Structures</td>
<td>Green Building</td>
</tr>
<tr>
<td>IS Codes on Design and Structural Safety Assessment</td>
<td>Disaster Management</td>
</tr>
<tr>
<td>Advanced Structural Design</td>
<td>Multivariate Analysis</td>
</tr>
<tr>
<td>Computational Earthquake Engineering</td>
<td>Remote Sensing</td>
</tr>
<tr>
<td>Structural Wind Engineering</td>
<td>Design of Hydraulic Structures</td>
</tr>
<tr>
<td>Probabilistic Methods in Structural Engineering</td>
<td>Illumination Engineering</td>
</tr>
<tr>
<td>Bridge Engineering</td>
<td>Hydro informatics</td>
</tr>
<tr>
<td>Earthquake Resistant Design of Masonry Structures</td>
<td></td>
</tr>
<tr>
<td>Plastic Theory of Structures</td>
<td></td>
</tr>
<tr>
<td>Seminar (half-course)**</td>
<td></td>
</tr>
</tbody>
</table>

The list of electives is only indicative.
** Seminar constitutes:

1. Student presentations on given subject area/research papers
2. Group discussions
3. Talks by industry experts
4. Writing technical papers/term papers

**Academic Regulations (Highlights)**

**Credit Requirements:**

- Student has to acquire a minimum of 66 credits in 4 semesters to become eligible to receive M. Tech in CASE degree. This can be achieved by acquiring credits as follows:
- Minimum 24 credits from Structural Engineering area
- Minimum 12 credits from Computer Science and IoT
- 18 credits from any SE or other electives of their choice (recommended minimum of 4 credits from each bucket)
- 12 credits from project work/internship in 4th semester
- Student can register a maximum of 20 credits either in 2nd or 3rd semester.
- Student can register up to a maximum of 2 Independent study courses in 2nd or 3rd semester
**Project Work/Internship:**

- Students are encouraged to do summer project/internship for 12 credits at IIIT Hyderabad or in construction industry/design consultancy.

**Grading Scheme**

- The grading for all courses will follow letter grading scheme with grade points stipulated by the institute.
- Project/internship completed in fourth semester (for 12 credits) will follow Excellent/Satisfactory/Unsatisfactory grading scheme without grade points.

**Academic Performance:**

- A student should complete the requirements with a minimum CGPA of 6.00 to receive the M.Tech degree.

**Choice Based Credit System:**

The curriculum aims to continue the implementation of Choice Based Credit System with a minimal core program followed by electives from across disciplines including mathematics, sciences, human sciences, engineering electives, and so on. The curriculum set aside close to 17% of the credits necessarily from courses outside of the program so as to allow scope for students to credit courses from the sciences, mathematics, human sciences, and engineering sciences. A total of 12% credits are set aside as open electives – student can use these credits to either go deeper in the program or to opt for courses outside of the program and broaden their outlook by opting for multi-disciplinary courses too.

All courses use a continuous evaluation model with a combination of homework assignments, quiz exams, mid-term, and final examinations. Students are required to stay clear of plagiarism in any of their work submitted for evaluation. Most elective courses include a course project or a term paper additionally. These course projects often require students to practice team-work, enhance their self-learning and communication skills, and impart essential project management skills. Some courses include a laboratory component with a scheduled laboratory session.

For the highly motivates students, the present curriculum continues to provide the Honors option which requires students to do additional credits including projects and advanced electives and work under the supervision of a faculty member.
# Course descriptions of Core and Elective Courses

<table>
<thead>
<tr>
<th>Title of the Course:</th>
<th>Structural Dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Name:</td>
<td>Sunitha Palissery</td>
</tr>
<tr>
<td>Name of the Program :</td>
<td>M.Tech CASE</td>
</tr>
<tr>
<td>Course Code</td>
<td>CE1.501</td>
</tr>
<tr>
<td>Credits</td>
<td>4</td>
</tr>
<tr>
<td>L - T - P</td>
<td>3-1-0</td>
</tr>
<tr>
<td>(L - Lecture hours, T-Tutorial hours, P - Practical hours)</td>
<td></td>
</tr>
<tr>
<td>Semester, Year</td>
<td>Monsoon 2022</td>
</tr>
<tr>
<td>Pre-Requisites</td>
<td>Mechanics of Materials &amp; Structural Analysis</td>
</tr>
<tr>
<td>Course Outcomes</td>
<td></td>
</tr>
</tbody>
</table>

After completion of this course successfully, the students will be able to:

**CO-1.** Develop knowledge and skills to mathematically express dynamics of structural systems

**CO-2.** Employ the computer application skills in developing structural dynamics tools for predicting structural response to dynamic loading like earthquakes

**CO-3.** Demonstrate problem solving skills for various scenarios of structural dynamics and work towards a research-based approach to the course

**CO-4:** Develop critical thinking to help improve dynamic responses of structures

**CO-5.** Analyze ethical and effective structural design practices in line with good dynamic response of structures under earthquake loading

**CO-6.** Reorganise inter-personal skills required to manage possible inter-disciplinary, inter-departmental collaborations in structural engineering and thus in structural dynamics

<table>
<thead>
<tr>
<th>Course Topics</th>
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<tbody>
<tr>
<td><strong>Unit 1:</strong> Response of simple Single Degree of Freedom (SDOF) systems</td>
</tr>
</tbody>
</table>

Introduction to structural dynamics; Definition of DOF; idealization of structure as SDOF system; Formulation of equations of motion for various SDOF systems; Free vibration of systems; Damping in structures; Undamped Systems; Forced vibration of systems; Steady state response to harmonic forces; Experimental determinations of natural frequency; Duhamel's integral and other methods.
**Unit 2**: Analysis of Multi-Degree of Freedom (MDOF) systems

Static force displacement relationship; Strain energy of system; Formulation of equation of motion; Evaluation of natural frequencies and modes; Free vibration of undamped systems; Forced vibration of damped systems; Review of time history & response spectrum methods.

**Unit 3**: Numerical Methods, and Approximate methods of computing natural frequencies

Eigen value problems and applications: Mode superposition principle; modal truncation errors; Ritz Vector approach; Direct Integration methods: Explicit methods - Central difference method; Implicit methods - Newmark-β method; Rayleigh's method; Dunkerley's method; Rayleigh-Ritz method

**Unit 4**: Base excited systems

Formulation of equations of motion for SDOF and MDOF systems; Concept of spectral quantities; Response spectrum; Fundamentals of earthquake engineering; Discussion on IS 1893 (1):2016 provisions for buildings.

**Unit 5**: Overview of dynamics of continuous systems

Vibration of flexural beams and shear beams: Equation of motion; Free vibration and Forced vibration

**Preferred Text Books**:


**Reference Books**:


**E-book Links**:

**Grading Plan**

(The table is only indicative)
<table>
<thead>
<tr>
<th>Type of Evaluation</th>
<th>Weightage (in %)</th>
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<tr>
<td>Quiz-1</td>
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<td>Mid Sem Exam</td>
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<tr>
<td>Quiz-2</td>
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<tr>
<td>End Sem Exam</td>
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<td>Assignments</td>
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<td>Project</td>
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</table>

Mapping of Course Outcomes to Program Objectives:

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<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
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<th>PS O2</th>
<th>PS O3</th>
<th>PS O4</th>
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<td>C O2</td>
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<td>C O4</td>
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<td>C O6</td>
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Teaching-Learning Strategies in brief (4-5 sentences):

1. Lectures by integrating ICT into classroom teaching
2. Tutorials involving numerical examples to reinforce structural dynamics concepts
3. Assignments involving analysing structural data to understand dynamic response earthquake data for predicting earthquake response of SDOF and MDOF structural systems
4. Critical and active learning through projects, and project-based learning by doing term-projects which involves hands-on use of computer programming skills and software tools.

Faculty Name: Lini Teresa Thomas
Course Name: Computer Problem Solving

NAME OF FACULTY: Lini Thomas
Name of the Academic Program: MTech CASE
Course Code: CS0.301
Title of the Course: Computer Problem Solving
L-T-P: 3-1-3
Credits: 4

1. Prerequisite Course / Knowledge:
None

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1: Demonstrate an understanding of computer programming language concepts.

CO-2: Ability to design and develop C programs, implement the concept of pointers, declarations, initialization, operations on pointers and their usage, arrays, functions. Able to define data types and use them.

CO-3: Ability to define and manage data structures based on problem subject domain.

CO-4: Ability to analyse the complexity of the solution offered.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping
4. Detailed Syllabus:

Unit 1: Basics of C Programming, Variables declaration, Input-Output, Operators

Unit 2: Arrays and Strings and Control Statements

Unit 3: Functions, Pointers

Unit 4: File Handling, Memory management

Unit 5: Stacks, queues, Linked Lists

Unit 6: Sorting Algorithms

Unit 7: Understanding Algorithm Complexity

Unit 8: Problem Solving and Computations Thinking

Reference Books:

1. The C Programming Language - Brian Kernighan and Dennis Ritchie
3. How to solve it by computer, R. Dromey, Prentice-Hall India

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

Any concept introduced in the lecture is followed by implementation in the lab session and further discussion and practice on the same in the tutorial. Assignments help students to think about implementing the most efficient solution. Project is to be chosen from the domain the student is from. This brings in a practical application of programming to the field of work.

6. Assessment methods and weightages in brief (4 to 5 sentences)

Term Papers(2): 15% + 20%
Quizzes: 20%
Lab Exams: 10%
Name of Faculty: Venkateswarlu Mandadi
Course Code: CE4.501
Title of the Course: Finite Element Method
L—T—F: 3-1-0;
credits: 4

1. **Prerequisite:** Calculus, Linear algebra
2. **Course Outcomes**

<table>
<thead>
<tr>
<th>CO</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solution by Weak formulation of Boundary Value Problems</td>
</tr>
<tr>
<td>2</td>
<td>Solution of Poisson Equation</td>
</tr>
<tr>
<td>3</td>
<td>Solution by Variational Formulation</td>
</tr>
<tr>
<td>4</td>
<td>Solve steady state problems in heat transfer</td>
</tr>
<tr>
<td>5</td>
<td>Solve steady state problems in solid mechanics</td>
</tr>
<tr>
<td>6</td>
<td>Initial value and eigenvalue problems</td>
</tr>
</tbody>
</table>

3. **Course Articulation Matrix**

<table>
<thead>
<tr>
<th>Course outcomes</th>
<th>Program Outcomes</th>
<th>Program Specific Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td>1 2 3 4</td>
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<tr>
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<td>3 3 3 2 3 1</td>
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<td>3 2 2 1 2 1</td>
<td>1 1 1 2</td>
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</table>
4. **Detailed Syllabus**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Galerkin method, Axially loaded bar, Heat conduction in one dimension, Heat conduction with convection transfer.</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Poisson equation, Triangular element, Rectangular element, Heat conduction in two and three dimensions.</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Variational functional, Ritz method, Euler-Bernouli beam, Finite element solution of beam</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Basic equations of elasticity, Torsion problem, Finite element solution of torsion problem, Plane stress</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Isoparametric elements — one dimensional, two dimensional, triangular; Numerical integration</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Helmholtz equation, Natural frequencies</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Parabolic equations, Hyperbolic equations</td>
<td>3</td>
</tr>
</tbody>
</table>

**References:**

J.N. Reddy, An introduction to the finite element method

S.S. Rao, The finite element method in engineering

Y.W. Kwon, The finite element method

5. **Teaching-Learning Strategies**

Lectures in class room, weekly tutorials on problem solving, active learning by students.

6. **Assessment Methods and Weightage**

Assignments 20, Quizzes 20, Mid Semester 20, End Semester 40 marks.
Title of the Course: Structural Engineering Design Studio
Faculty Name: Pradeep Kumar Ramancharla
Course Name: Structural Engineering Design Studio
Name of the Academic Program: M.Tech in Computer Aided Structural Engineering
Course Code: CE1.602
L-T-P: 3-1-0
Credits: 4

1. Prerequisite Course / Knowledge:
B.Tech in Civil Engineering subjects i.e., Engineering Mechanics, Reinforced Concrete Design, Structural Analysis.

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):
After completion of this course successfully, the students will be able to..

CO-1  Use the understanding of the structural analysis concepts of structural components, for structural system design;

CO-2  Write computer programs, to develop structural analysis software;

CO-3  Analyse the structure using commercially available software

CO-4  Design the components and systems using commercially available software

CO-5  Appreciate the challenges in construction industry and get equipped to address some of the challenges

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

<table>
<thead>
<tr>
<th></th>
<th>PO 1</th>
<th>PO 2</th>
<th>PO 3</th>
<th>PO 4</th>
<th>PO 5</th>
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Note: ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low'-level’ mapping

4.Detailed Syllabus:


Unit 2: Numerical Methods – Bi-Section Method, Gauss Elimination, Newton-Raphson


Unit 4: Application of MATLAB – Analysis of Beams & Frames, Gravity and Lateral Load Analysis of Frames, Analysis of Planar Trusses.


Reference Books:

5. Teaching-Learning Strategies in brief (4 to 5 sentences):
A lecture on a theory concept will be preceded by its practical relevance, appreciation of field level challenges and immediately followed by on-hands-practice using manual approach as well as using appropriate scientific software. Student will be encouraged to come up with issues and how the theory and hands-on experience is helping them. Student is also encouraged to do homework and assignments individually and mini-projects as a group task.

6. Assessment methods and weightages in brief (4 to 5 sentences):
The course will rely heavily on looking at problem solving capability of student and hence the assessment is divided as follows i.e..

a) 20% weightage is given to individual assignments for checking the concepts taught in the class,
b) 20% weightage is for group projects for checking software application
c) 30% is quizzes & Mid exam for checking the application of concept and,
d) 30% for end-sem exam is for overall assessment.

NAME of Faculty: Dr. P. Pravin Kumar Venkat Rao

Name of the Academic Program: M.Tech in CASE

Course Code: CE0.501

Title of the Course: Theory of Elasticity

L-T-P: 3-1-0

Credits: 4

1. Prerequisite Course / Knowledge: Solid Mechanics/Strength of Materials

2. Course Outcomes (COs):
After completion of this course successfully, the students will be able to:

CO 1: Explain the basics concepts of stress, strain, tensor, vector, traction, and important properties of solids.
CO 2: Discuss the fundamental theories of elasticity.

CO3: Idealize the physical systems through mathematical equations.

CO4: Represent the state of stress and strain in a body (2D and 3D) with respect to different planes or orientations.

CO5: Analyze the boundary value problems using equilibrium, compatibility, and constitutive relations.

CO 6: Derive the governing equations and their solutions for application to problems in plane stress and plane strain state, torsion and bending.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping

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4. Detailed Syllabus:

Unit 1: Elasticity and its types, Inelastic material, Difference between theory of elasticity and strength of material, Materials and its properties, Assumptions in elasticity, Mathematical preliminaries: cartesian co-ordinates, introduction to tensor, matrix representation, operators and symbols.

Unit 2: Concept of stresses and strains, Infinitesimal area and volume, 2D and 3D stress tensor, Stress and strain transformation at a point in an elastic body, Difference between stress and traction, Cauchy’s stress, Components of traction, Strain tensors, Types of deformation, Measurement of surface strains
Unit 3: Rigid body translation and rotation of an element in space, Generalized Hook’s law, Stress-strain relationships, Equilibrium equations, Strain-displacement relationships, Compatibility conditions, Constitutive relations.

Unit 4: Principal planes, Principal stresses and invariants, Octahedral plane and stresses, Deviatoric stress, Hydrostatic stress, Plain stress, Plain strain, Formulation of boundary value problems in equilibrium and compatibility, Stress functions, Biharmonic equation, Solution of 2D problems by the use of polynomials.

Unit 5: Torsion of bars, Saint venant principle, Rigid body rotation, Bending of beams, Elastic stability, Factors affecting lateral stability, Analysis of beam-column with different loading conditions, Different types of buckling.

Reference Books:

8. NPTEL Lecture Notes: IIT, Madras.

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

In this course the concept of elasticity, an important property of solids will be discussed in a comprehensive way. Idealization of physical system, representing the idealized system through mathematical equation and finally finding solution of those equations are the key features that constitute the structure of this course. In this course emphasis will be given on both theory and applications.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Assignments and Quizzes - 40%
Mid Semester Exam - 25%
End Semester Exam - 35%

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Title of the Course:     **Computing Tools**

Name of the Faculty:  VikramPudi

Name of the Academic Program  **M.Tech. in CASE, Bioinformatics (1\textsuperscript{st} year, 2\textsuperscript{nd} semester)**

Course Code:            **CS0.302**

L-T-P                  3-1-3

Credits               4

**Prerequisite Course / Knowledge:**

1. First course on programming and problem-solving
2. Basics of Python language, to be able to use relevant libraries and toolkits

**Course Outcomes (COs):**

After completion of this course successfully, the students will be able to:

CO-1. Model and create datasets.

CO-2. Visualize and present data.

CO-3. Collect data from across networks and internet to store in databases

CO-4. Prepare and preprocess datasets to make them ready for application of various data analytics algorithms.

CO-5. Employ known algorithms to solve common analytics tasks in practical applications, setting their parameter values, and using relevant libraries and toolkits.

CO-6. Evaluate and determine the best algorithm among known algorithms for specific datasets and applications.

**Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)**

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Detailed Syllabus:

Unit 1: Databases (Design, SQL)

Unit 2: Visualization (e.g. Bokeh, VTk)

Unit 3: Networking and data collection (e.g. requests and json modules)

Unit 4: Scientific Python Modules: NumPy, Matplotlib, Tkinter, SciPy

Unit 5: Data analytics: Preprocessing, Clustering, Classification (e.g. pandas, scikitlearn)

Reference Books:

1. Official documentation and online tutorials on Python, VTk, etc.
2. Python – [https://docs.python.org/3/tutorial/](https://docs.python.org/3/tutorial/)

Teaching-Learning Strategies in brief (4 to 5 sentences):

This is a highly practicals-oriented course. Lectures showcase handson usage of various computing tools and modules for interdisciplinary students. Theoretical concepts in database design and data analytics are also covered with a practical focus, with examples and assignments. A mini-project is given in each module. Mini projects may be done in groups of 3. Lab exams may be done as a single large problem with intermediate milestones and choice of 1 out of 3 problems to solve. Python modules specified are suggestive and may be replaced with better ones.

Assessment methods and weightages in brief (4 to 5 sentences):

- Mini Projects: 5x10=50%
- Lab reports: 10%
Title of the Course: **IoT Workshop**

Faculty Name:

Course Code: **CE9.609**

L-T-P: **1-0-3** Credits: **4**

(L= Lecture hours, T= Tutorial hours, P= Practical hours)

Name of the Academic Program: **MTech CASE**

**1. Prerequisite Course / Knowledge:**

Basic computer programming (C), 10+2 level physics, basics of structural engineering

**2. Course Outcomes (COs)**

After completion of this course successfully, the students will be able to

**CO-1(Understand)** : Explain the basic elements of an IoT system and the application of IoT for structural engineering.

**CO-2(Analyze)** : Analyze and solve basic electrical circuits using Kirchhoff’s laws

**CO-3(Understand)** : Describe the working principle of commonly available sensors and actuators.

**CO-4(Understand)** : Explain the working on microcontrollers, peripherals and its programming.

**CO-5(Apply)** : Write simple embedded programs and interface common sensors and actuators with Arduino and ESP 32 boards

**CO-6(Remember)** : State and identify different technologies related to Communications and Networking, Cloud Computing and Data Analysis, Interoperability Standards and security, Dashboard and Visualization

**CO-7(Create)** : Assess simple designs from IoT application point of view

**CO-8(Create)** : Develop and implement an IoT-based solution for a real-life problem in the domain of structural engineering

**3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix**
Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://intranet.iiit.ac.in/offices/static/files/PEOs%2C_POs_and_PSOs_of_all_the_Programmes_Offered-29.7.2022.pdf

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4. Detailed Syllabus:

1. Basic properties of electricity and electrical circuits - DC, Voltage, Current, Power, Energy, Resistance, Ohm’s Law, Circuit Diagrams
2. Kirchoff’s voltage and current laws, series and parallel resistance, Voltage and Current divider
3. Online Simulations using TinkerCAD
4. Basic Circuits, Mesh analysis, Node analysis.
8. Peripherals: RTC, ADC channels, resolution, onboard memory, power, external/internal watchdog
9. Communications and Networking in IoT
10. Cloud Computing and Data Analysis
11. Interoperability Standards and security
12. Dashboard and Visualization
13. Documentation and Productization

Reference:

1. Raj Kamal, Internet of Things, McGraw Hill, 2018
2. P. Lea, Internet of Things for Architects, 2018

5. Teaching-Learning Strategies in brief:

Lectures will be integrating ICT into classroom teaching, active learning by students, and project-based learning by doing an IoT-based project.

6. Assessment methods and weightages in brief:

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Title of the Course: Earthquake Resistant Design of Masonry Structures
NAME of Faculty: Dr. P. Pravin Kumar Venkat Rao

Name of the Academic Program: M.Tech in CASE

Course Code: CE1.607

L-T-P: 3-1-0

Credits: 4

1. Prerequisite Course / Knowledge: Strength of Materials, Structural Analysis, Structural Design (RC or Steel), and preferably Seismic Design of Structures

2. Course Outcomes (COs):

After completion of this course successfully, the students will be able to:

CO 1: Understand the seismic vulnerability of existing masonry structures against seismic forces.

CO 2: Acquainted with principles of earthquake resistant design of masonry structures

CO 3: Understand the failure modes and complete behaviour of masonry under different actions like: compression, tension, shear, and bending

CO 4: Analyze the seismic safety of masonry buildings and suggest the retrofit measures using codal provisions.

CO 5: Design the strengthened masonry components of a building using different techniques.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

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Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping

4. Detailed Syllabus:
Unit 1: Introduction to masonry, Masonry buildings in India, Material properties, Masonry units- stones, brick and concrete blocks, hollow and solid units, Manufacturing process, Mortar, Grout, and reinforcement; Masonry assemblages, Masonry systems, Various tests, and standards.

Unit 2: Masonry under compression: Prism strength, Failure mechanism, types of construction and bonds, Eccentric loading, Slenderness – effective length and effective height, effect of openings, Code provisions, masonry in tension, flexural strength of masonry, shear and bending capacity of masonry.

Unit 3: Behaviour of masonry structures during past earthquakes: Common modes of failures, effect of roof and floor systems, Masonry under lateral loads: In-plane and out-of-plane loads, bending parallel and perpendicular to bed joints, Shear and flexure behaviour of piers, Test and standards, lateral force distribution for flexible and rigid diaphragms, Combined axial and bending actions.

Unit 4: Earthquake Resistant Measures: Analysis for earthquake forces, role of floor and roof diaphragm, Pier analysis using equivalent stiffness approach, Concept and design of bands, splints and bandages, Vertical reinforcement at corners and jambs, Code provisions.

Unit 5: Retrofitting of masonry building: Techniques of repair and retrofitting of masonry buildings, IS: 13935 provisions for retrofitting, different strengthening methodologies and techniques.

Reference Books:


5. Teaching-Learning Strategies in brief (4 to 5 sentences):

The course aims at elucidating theories on mechanical behaviour of masonry assemblages under different actions and introduces the working stress and limit state approaches to analysis and design of masonry structures for gravity and lateral loads due to earthquake. The course will also briefly address structural safety assessment and strengthening of existing masonry structures.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Assignments and Quizzes - 40%
Mid Semester Exam - 25%
End Semester Exam - 35%

---------------------------------------------------------------

Faculty Name: Pradeep Kumar Ramancharla
Course Name: IS Codes on Design and Structural Safety Assessment
Mobile: 9391131199
Email: ramancharla@iiit.ac.in

NAME OF FACULTY: R Pradeep Kumar

Name of the Academic Program: M.Tech in Computer Aided Structural Engineering

Course Code: CE1.6

Title of the Course: IS Codes on Design and Structural Safety Assessment

L-T-P: 3-1-0

Credits: 4

1. Prerequisite Course / Knowledge:
B.Tech in Civil Engineering subjects i.e., Reinforced Concrete Design, Structural Analysis.

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):
After completion of this course successfully, the students will be able to..

CO-1 Use the understanding of the code provisions in the design of structures;
CO-2 Explain the basis behind code provisions;
CO-3 Analyse and design the structure using commercially available software
CO-4 Compare the provisions of Indian standards with other relevant international standards
CO-5 Demonstrate understanding of the challenges in construction industry and get equipped to address some of the challenges

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

| PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
4. Detailed Syllabus:

Unit 1: IS Code provisions: Design of RC structures, tall buildings, detailing, assessment and retrofitting


Unit 4: IS 13920-2016: Ductile Design & Detailing of RC structures subjected to seismic forces – Code of Practice: General specifications, Beams, Columns & Inclined members, Special Confinement reinforcement, Beam-column joint, Special shear walls, Gravity columns in buildings.


Reference Books:

1. IS 16700-2017: Criteria for Structural Safety of Tall Concrete Buildings
2. IS 1893-2016: Criteria for Earthquake Resistant Design of Structures
3. IS 13920-2016: Ductile Design & Detailing of RC structures subjected to seismic forces – Code of Practice
4. IS 456-2000 Plain and Reinforced Concrete - Code of Practice
5. IS15988-2013: Seismic evaluation & strengthening of existing RC Buildings-Guidelines

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

A lecture on a theory concept will be preceded by its practical relevance, appreciation of field level challenges and immediately followed by on-hands-practice using manual approach as well as using appropriate scientific software. Student will be encouraged to come up with issues and how the
theory and hands-on experience is helping them. Student is also encouraged to do homework and assignments individually and mini-projects as a group task.

6. Assessment methods and weightages in brief (4 to 5 sentences):
The course will rely heavily on looking at problem solving capability of student and hence the assessment is divided as follows i.e.,

a) 20% weightage is given to individual assignments for checking the concepts taught in the class,
b) 20% weightage is for group projects for checking software application

c) 30% is quizzes & Mid exam for checking the application of concept and,
d) 30% for end-sem exam is for overall assessment.

NAME of Faculty: Dr. P. Pravin Kumar Venkat Rao
Name of the Academic Program: M.Tech in CASE
Course Code: CE1.603
Title of the Course: Advanced Structural Analysis
L-T-P: 3-1-0
Credits: 4

1. Prerequisite Course / Knowledge: Basic Structural Analysis

2. Course Outcomes (COs):
After completion of this course successfully, the students will be able to:

CO 1: Develop the stiffness matrix for prismatic members and have a sound knowledge of matrix computations.

CO 2: Analyze determinate and indeterminate plane and space truss/frame system.

CO3: Derive the collapse load factors for a given structure

CO4: Understand how standard software packages (routinely used for frame analysis in design offices) operate.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping
4. Detailed Syllabus:

Unit 1: Linear and non-linear analysis, Types of structures, Idealized structure, type of elements, type of connections, Degree of freedom, Degree of static and kinematic indeterminacy. Introduction to stiffness and flexibility approach.

Unit 2: Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame, and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, Effect of sinking and rotation of a support.

Unit 3: Analysis of spring and bar assembly, Analysis of plane truss, space truss, plane frame, plane grid and space frames subjected to joint loads, Analysis of structures for axial load, Frames with inclined members, Analysis for member loading (Self, Temperature & Imposed), Inclined supports, Lack of fit, Initial joint displacements, Effect of shear deformation, Inclined roller supports.

Unit 4: Elastic and plastic behaviour of steel, Plastic hinge, Fundamental conditions for plastic analysis, Combination of mechanisms, Theorems of plasticity, Mechanism method, Statical method, Uniformly distributed loads, Continuous beams and frames, Collapse load analysis for prismatic and non-prismatic sections.

Reference Books:

5. **Teaching-Learning Strategies in brief (4 to 5 sentences):**

In this course, the main objective is to enable the student to have a good grasp of all the fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, developing analytical, and intuitive skills.

6. **Assessment methods and weightages in brief (4 to 5 sentences):**

- Assignments and Quizzes - 40%
- Mid Semester Exam - 25%
- End Semester Exam - 35%

Title of the Course: Stability of Structures
Faculty Name: Sunitha Palissery
Course Code: CE1.612
L-T-P: 3-1-0
Credits: 4

Name of the Academic Program: M. Tech in CASE

1. **Prerequisite Course / Knowledge:** Design of RC and Steel Structures (Undergraduate course content)

2. **Course Outcomes (COs):**

After completion of this course successfully, the students will be able to:

- CO-1. Develop knowledge and skills to mathematically formulate structural stability criteria of steel members
- CO-2. Employ the computer application skills in developing structural models to perform buckling analysis and predict stability of frames
- CO-3. Demonstrate problem solving skills for various instability modes and work towards a research-based approach to the stability design of steel frames
- CO-4: Apply buckling and stability analysis methods, to address practical stability design problems
- CO-5. Analyze ethical and effective structural design practices to preclude stability failure of steel structures and towards reasonably good behavior under extreme loading conditions
CO-6. Reorganize inter-personal skills required to manage possible negotiations with structural engineering design practitioners towards a stable steel structure.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

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Note: ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping

4. Detailed Syllabus:

Unit 1: Basic Concepts of Stability
Bifurcation Buckling- Methods of Stability Analysis-Post-buckling Behaviour-Large Deflection Analysis

Unit 2: Buckling of Columns and Frames
Differential Equations using Equilibrium, Large Deformation Theory, Effects of Imperfections, Inelastic Buckling – Tangent and Reduced Modulus Concepts, Shanley’s theory of Inelastic Column Behaviour, Effects of Residual Stresses-Beam Columns; Modes of Buckling- Frame Stability Analysis-Non-sway and Sway Frames-Critical Load Estimation using Slope Deflection Equations

Unit 3: Torsional and Flexural-Torsional Buckling and Buckling of Plates
Thin-walled Open Cross-Sections-Columns-Beams-Beam Columns; Governing Differential Equations for Plate Buckling, Plates Subjected Loading Actions, Post-buckling Behaviour of plates

Unit 4: Introduction to behavior of Steel Beams and Beam Columns
Limit State Design; Classification of sections; Buckling classifications; Laterally Restrained and
unrestrained beams, Effective Length of Columns- AISC Alignment Charts; stability index,
Design Strength

Unit 5: Design of Beam Columns

Interaction equations, Design for combined axial and bending effects; computer analysis of rigid
steel frames

Reference Books:

   and Damage Theories*, World Scientific Publishing Co. Pvt. Ltd., Singapore
   Construction in Steel, IS800;2007, New Delhi, India
   Applications for Structural Engineers*, John Wiley & Sons, New Jersey
   International Book Company
    Hall, NJ

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

   1. Lectures by integrating ICT into classroom teaching
   2. Tutorials involving mathematical formulation and graphical analysis of stability problems
   3. Assignments involving analysing structural data to understand buckling behaviour of steel
      members and frames
   4. Critical and active learning through projects, and project-based learning by doing term-
      projects which involves computer programming and hands-on use of software tools to
      investigate & predict stability behaviour of members and frames.

6. Assessment methods and weightages in brief (4 to 5 sentences):

   Assignments in theory: 20 marks, Quizzes in theory: 10 marks, Mid Semester Examination in
   theory: 20 marks, Term-project: 20 marks, End Semester Examination in Theory: 30 marks

Title of the Course: Advanced Structural Design
Faculty Name: Sunitha Palissery

Name of the Program: M.Tech CASE

Course Code: CE1.604

Credits: 4

L - T - P: 3-1-0

(L - Lecture hours, T - Tutorial hours, P - Practical hours)

Semester, Year: Monsoon 2022

(Ex: Spring, 2022)

Pre-Requisites: Design of RC and Steel Structures (Undergraduate course content), Stability of Structures

Course Outcomes:

After completion of this course successfully, the students will be able to:

CO-1. Develop knowledge and skills to numerically model, analyze and design reinforced concrete and steel moment frame buildings

CO-2. Employ the computer application skills in developing structural behavior intuition and predict structural response to dynamic loading like earthquakes

CO-3. Demonstrate problem solving skills for various scenarios of structural design and work towards a research-based approach to the seismic design of structures

CO-4: Develop critical thinking to help improve and control structural behavior, with focus on seismic loading effects on moment frame buildings and other structural systems

CO-5. Analyze ethical and effective structural design practices in line with good seismic behavior of structures under earthquake loading

CO-6. Reorganize inter-personal skills required to manage possible negotiations with structural engineering design practitioners and promote a seismically safe built environment

Course Topics:

Unit 1: Seismic Elastic and Inelastic Behaviour of Structures

Configuration, Structural Plan Density, Initial proportioning, estimation of loads and load combinations, numerical modelling concepts, interpretation of linear elastic structural analysis and modal analysis results- concept of lateral stiffness, strength, ductility, collapse mechanism, deformability, energy dissipation.

Unit 2: Seismic Design Recommendations in Indian and International Design Standards


Unit 3: Seismic Design of Reinforced Concrete Special Moment Frame Building
Design and detailing of RC structural members for loading effects: axial, flexure, shear design for combined effects; RC beam-column joints

**Unit 4:** Seismic Design of Steel Special Moment Frame Building

Design of steel members, connections: Joint panel zones, prequalified connections; Design of Column Bases

**Unit 5:** Nonlinear Static Behaviour of Special Moment Frame Buildings

Nonlinear static response: Lateral Stiffness, Lateral Strength, Ductility Capacity, Collapse Mechanism and Energy Dissipation Capacity of RC and Steel Building Designed as part of the course.

Preferred Text Books:


Reference Books:

1. American Concrete Institute (ACI), (2014), Building Code requirements for Structural Concrete (ACI 318-14), Farmington Hills, MI, USA
3. American Institute of Steel Construction (AISC), (2016), Specifications for Structural Steel Buildings, (ANSI/AISC360-16), Chicago, Illinois, USA
4. American Society of Civil Engineers (ASCE), (2010), Minimum Design Loads for Buildings and Other Structures (ASCE 7-10), USA
5. American Society of Civil Engineers (ASCE), (2013), Seismic Rehabilitation of Existing Buildings, (ASCE/SEI 41-13), Virginia, USA
8. Bureau of Indian Standards (BIS), (2016), Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Code of Practice, IS 13920:2016, New Delhi, India

**E-book Links**

**Grading Plan**

(The table is only indicative)

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**Mapping of Course Outcomes to Program Objectives:** (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

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Teaching-Learning Strategies in brief (4-5 sentences):

1. Lectures by integrating ICT into classroom teaching
2. Tutorials involving numerical modelling of reinforced concrete and steel moment frame buildings to reinforce linear and nonlinear structural analysis concepts and seismic design methods commonly used in design practice
3. Assignments involving analysing structural data to understand linear and nonlinear static response of buildings
4. Critical and active learning through projects, and project-based learning by doing term-projects which involves hands-on use of software tools to investigate and predict nonlinear behaviour of buildings under earthquakes.

Title of the Course : Structural Wind Engineering
Faculty Name : Shaik Rehana
Name of the Program : Computer-aided Structural Engineering (CASE) M.Tech (CASE)
Course Code : CE1.509
Credits : 4
L - T - P: L-T-P: 3-1-0
(L - Lecture hours, T-Tutorial hours, P - Practical hours)
Semester, Year : Monsoon 2022
(Ex: Spring, 2022)

Pre-Requisites:
Basics of Fluid Mechanics, Fluid Dynamics, Boundary Layer Theory, Turbulent Flow, Structural Dynamics

Course Outcomes:
After completion of this course successfully, the students will be able to:

CO-1: Design wind speed profiles and structural interaction with aerodynamic forces

CO-2: Design wind loads for various types of buildings such as single and multistoried structures subjected to various terrains and wind profiles

CO-3: Synthesize the wind induced responses under extreme wind speeds
CO-4: To assess the wind damages and wind impact on structures

CO-5: To assess the wind loads as per the codes and standards

Course Topics:
(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

- Wind climate, nature and types of high winds and storms
- Wind damages, damage index, wind impact on structures
- Estimation of design wind speed and pressure distribution
- Estimation of wind loads on buildings, factors affecting wind load
- Prediction of design wind speed and structural safety
- Estimation of extreme wind speeds
- Atmospheric boundary layer and wind turbulence: mean wind speed profiles, wind spectra, topographic multipliers
- Structural interaction with aerodynamic forces, pressure, lift, drag and moment effects on structures
- Wind loads, codes and standards

Preferred Textbooks:

Reference Books:

E-book Links:

Grading Plan:
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https://iiitaphyd-my.sharepoint.com/:w:/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111f0effcaea41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

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**Teaching-Learning Strategies in brief (4-5 sentences):**

Lectures and tutorials on design of wind loads for diverse type of practical structures. Hands on session to solve and design wind induced structures such as tall and multistorey buildings with
diverse terrains and wind profiles. Term projects with real-time case studies for developing design tools for the quantification of wind loads for user-defined structural requirements.

Note: This course description format comes into effect from Monsoon 2022.

Title of the Course : Spatial Informatics
Course Code : CSE591
Credits : 3-1-0-4
Faculty Name : Rajan KS

TYPE-WHEN: Open Elective
PRE-REQUISITE : Open to UG-3, UG-4, DD/MS, and PhD students

OBJECTIVE : Spatially explicit information like a map (e.g. Google Maps) informs us not just the geographical location but also the relationship between the objects in it. While mapping models focus on the Spatial (and Temporal) data collection, storage and management (Spatial DBMS) with map generation as one of the key elements; the recent advances in technology have expanded the horizon to include Spatio-temporal Analytics, 3D GIS, Ontology and GML, etc.

This course gives an introduction to the concepts of GIS, the science and algorithms behind it and how this technology can benefit many disciplines, including navigation, transportation and traffic planning, Urban planning, hydrology, environmental management, disaster response, etc.

COURSE TOPICS: Course Structure (each of approximately 1-2 week duration):

1. What is Geographical Information Systems (GIS)?
2. Fundamental concepts of Space
3. Geospatial data and its Digital representation – Vectors and Rasters
4. GIS Data collection, Editing and Data formats
5. Data structures for Spatial data and Spatial data management (Geospatial database)
6. Spatial Data Query and Analysis – Spatial Analysis, Network Analysis
7. Data compatibility - Projections and Georeferencing
8. Spatial reasoning and uncertainty
9. Web-GIS, GML and Map services
10. Geospatial applications in few areas like in Hydrology (Water flows and floods); Ecology and Environment; Land use and Land cover; Urban planning and Transportation; etc.
11. Topics in Spatial Informatics
1. 3DGIS
2. Open Source Initiatives in GIS/RS

A few lectures, may be given by Invited Speakers in related areas during the course to provide the students a wider understanding of its relevance and application.

In addition, there will be a hands-on (lab tutorials) introduction to one or two GIS software and tools at relevant times during the course.

PREFERRED TEXT BOOKS:

1. Geographical information systems and science by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind
2. Introduction To Geographic Information Systems by Kang-Tsung Chang
3. GIS--A computing perspective by Michael Worboys and Matt Duckham
4. Concepts and techniques of geographic information systems by C P Lo and Albert K W Yeung

Course Assessment Plan (Monsoon 2020)

Assignments - 10%

Project - 20%

Any other - 30%

Quiz - 20%

Open Book Exam/

30 Min Quiz - 20%

OUTCOME: Students will learn the basic concepts of Geospatial data representation, cartography, visualization, data manipulation and how to extract meaningful information from it. In addition, they will be exposed to the application potential of this fast developing domain cutting across disciplinary interests.

Name of the Academic Program: MS. in IT in Building Science

Title of the Course: Green Buildings

Course Code: CEG422

L-T-P: 3-1-0. Credits: 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)
Prerequisite Course / Knowledge:
Building Services

Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1. Understand the concepts of green buildings and be able to apply them in real building projects

CO-2. Apply the green building concepts to evaluate projects for rating systems such as LEED, GRIHA, IGBC

CO-3. Design buildings using various green concepts

CO4- Understand the inter-relationship between various aspects of buildings and do integrated design for overall building performance

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Detailed Syllabus:
1. Conventional building impacts
2. Introduction to Green Buildings
3. Impacts of building construction, operation, and disposal
4. The green building process and assessment
5. Ecological design
6. Sustainable sites and landscaping
7. Energy efficiency in buildings
8. Renewable energy
9. Water conservation
10. Sustainable and alternative materials
11. Indoor environmental quality
12. Construction Operations and Building Commissioning
13. Certification Systems
14. Sustainable Operations
15. Economic issues and future directions in green buildings

**Studio-**
Analysing a building such as school, hospital for their performance from the perspective of a green building rating system

Redesigning the same building for improved performance

**References:**

4. Green Building Fundamentals (2nd Edition), Mike Montoya, Pearson Education
5. Fundamentals of Integrated Design for Sustainable Building, Marian Keeler, Bill Burke, John Wiley and Sons
6. IGBC reference guide
7. GRIHA manual

**Teaching-Learning Strategies in brief:**

**Project work:** Each student will evaluate an aspect of the IIIT campus from the point of view of a rating system and will submit his/her assessment and recommendations.

**Site Visits:** Site visit(s) to building(s)/campus(es) in Hyderabad which are designed or operated in sustainable manner.

Students will have to submit their individual site visit reports.

**Assessment methods and weightages in brief:**

Mid-term exams = 25% Studio work=50%

End semester Exam=25%

Title of the Course: **Disaster Management**

**Faculty Name:** Sunita P

Course Code: **CS1.501**

L-T-P: **3-1-1**.

Credits: **4**

(L= Lecture hours, T=Tutorial hours, P=Practical hours)
1. Prerequisite Course / Knowledge:

General awareness about disasters, computer programming skills, and electronic hardware knowledge to develop tools and aids to assist effective disaster management.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1. Develop awareness about natural and man-made disasters and help contribute holistically towards a disaster resilient community

CO-2. Employ the core area skills in developing disaster management tools and sensors

CO-3. Illustrate problem solving skills for various disaster scenarios and work towards a research-based disaster management for the country.

CO-4: Develop critical thinking to help policy making in disaster management activities

CO-5. Analyze ethical and effective disaster management practices and related e-governance

CO-6. Reorganise inter-personal skills required to manage inter-disciplinary, inter-departmental collaborations in disaster management

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

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</table>
4. Detailed Syllabus:

Unit 1: Disaster Management Cycle- Mitigation, Preparedness, Response, Rehabilitation, Reconstruction, Recovery, Resilience, Capacity Building (9 hours);

Unit 2: Institutional Arrangements-NDMA, SDMA, DDMA, FEMA (7 hours);

Unit 3: Management of Natural and Man-made- Case Studies- Flood, Drought, Earthquakes, Cyclones, Tsunami, Landslides, Avalanche, Forest Fire, Air Pollution, Terrorist attacks, Nuclear Disaster, Chemical Disaster (12 hours);

Unit 4: Role of Information and Communications Technologies in Disaster Management Mitigation, Preparedness, Response, Recovery-Early Warning Systems, Mobile Communications, Information Dissemination (7 hours);

Unit 5: Disaster Risk Analysis-Mapping, Modelling, Risk Analysis, Introduction to Risk Modelling & Analysis using softwares, hands-on training (QGIS) (7 hours)

References:

5. Federal Emergency Management Agency (FEMA), *Guidelines*, FEMA, USA

5. Teaching-Learning Strategies in brief:
Lectures by integrating ICT into classroom teaching, tutorials involving simulation modelling, analysing GIS data for predicting disasters, critical and active learning, and project-based learning by doing term-projects which involves hands-on use of computer programming skills and software/hardware tools applications.

6. Assessment methods and weightages in brief:

Assignments in theory: 20 marks, Quizzes in theory: 10 marks, Mid Semester Examination in theory: 20 marks, End Semester Examination in Theory: 30 marks, Term-project: 20 marks

Title of the Course: Multivariate Analysis

Name of Faculty: Venkateswarlu Mandadi

Course: CSE

Course Code: IMA409

L—T—F: 3-1-0; credits: 4

1. Prerequisite: Basic statistics, Matrix analysis, Calculus

2. Course Outcomes

After completion of this course, the students will be able to

| CO 1 | Explain the intricacies of simultaneous analysis of several variables |
| CO 2 | Discuss the theoretical foundation for multivariate analysis |
| CO 3 | Discuss the different areas of applications of multivariate analysis |
| CO 4 | Discuss the statistical inference in the context of several variables |
| CO 5 | Analyze the multivariate extensions of standard univariate procedures |
| CO 6 | Demonstrate the knowledge of the additional multivariate techniques and apply them to solve problems |

3. Course Articulation Matrix

<table>
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<th>Course</th>
<th>Program Outcomes</th>
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Note: 3 in the box denotes high level mapping, 2 for medium level and 1 for low level mapping

### 4. Detailed Syllabus

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Random variables, vectors, and matrices. Partitioning. Linear functions. Mahalanobis distance</th>
<th>3 hours</th>
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<tr>
<td>Unit 2</td>
<td>Multivariate Normal, properties, estimation of parameters, Maximum likelihood method, Wishart distribution</td>
<td>3 hours</td>
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<td>Unit 3</td>
<td>Hotelling T-square tests, likelihood ratio test, Union-Intersection test, Confidence intervals and Tests, Tests on subvector</td>
<td>6 hours</td>
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<tr>
<td>Unit 4</td>
<td>Multivariate analysis of variance, one way classification, Two-way analysis, Tests on subvector</td>
<td>6 hours</td>
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<td>Unit 5</td>
<td>Discrimination, Two groups, Several groups, Tests of hypotheses, Classification, Two groups, Several groups, Estimation of error rates</td>
<td>6 hours</td>
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<tr>
<td>Unit 6</td>
<td>Multiple regression, Multivariate regression, Fixed x’s, Estimation, Hypothesis tests.</td>
<td>6 hours</td>
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<td>Unit 7</td>
<td>Canonical Correlations and variates, Properties, Tests of significance, Interpretation of canonical variates</td>
<td>6 hours</td>
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</table>
Unit 8  |Principal Components, Methods for discarding components, Interpretation, Relationship between Principal Components and Regression | 3 hours
---|---|---
Unit 9 | Basic factor model, estimation of loadings and commonalities, Determining the number of factors, Rotation of factor loadings | 3 hours

References:
K.V. Mardia, Multivariate analysis, Publishers, Edition, Year?

5. Teaching-Learning Strategies

Lectures in class room, weekly tutorials on problem solving, active learning by students.

6. Assessment Methods and Weightage

Assignments: 20, Quizzes: 20, Mid Semester Exam: 20, End Semester Exam: 40 marks.

Title of the Course: **Optical Remote Sensing**

Course Code: **CEG461**

L-T-P: **3-0-1.**

Credits: **4**

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

Open Elective (Spring) (UG and PG)

1. Prerequisite Course / Knowledge:

   Basic Physics and computational knowledge.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1: Comprehend processes of optical remote sensing

CO-2: Describe various sensors and their image characteristics

CO-3: Extract information from satellite imagery using conventional methods CO-4: Apply advanced computational techniques for feature extraction

CO-5: Discuss satellite imagery applications (ex. Forest, Urban, Agriculture)
CO-6: Get basics of advanced remote sensing technologies

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

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4. **Detailed Syllabus:**

Unit-1: Introduction to Remote sensing: What is remote sensing? Earth Observation Satellites and Platforms(Evolution of platforms, sensors, satellites, national and international sensors)

Unit-2: Sensor and its characteristics – Classification; Remote sensing instruments, passive-active, imaging-non imaging, OIR-Microwave, framing-scanning, mechanical-pushbroom; Aerial photographs-satellite image; types of resolutions and their tradeoff

Unit-3: Physics of Electro Magnetic Radiation (EMR) EMR properties(characteristics-wave model- particle model; Radiation laws applicable to remote sensing: EMR interaction with Atmosphere and Earth materials: EMR interactions with atmosphere, atmosphere structure,

Atmosphere blinds – windows; Absorption-scattering mechanism- types; EMR interactions with earth surface material-Specular - Diffuse; Albedo.

Unit-4: Data acquisition and image characteristics: Data creation at sensor level – telemetry- ground station acquisition: Old data formats (BIL, BIP, BSQ) and current ; Data products: Special Products – Processing software, Image characteristics, and FCC creation-types. Additional ways of Acquiring data in Non-optical or near Optical Image processing

Unit-5: Image pre-processing: Image restoration- Atmosphere errors, correction-methods; Correcting geometric distortions – Types of errors, Spatial and pixel interpolation (types), map
projections and types: Image Enhancement - Contrast and Spatial enhancement, Hue, Intensity, and Saturation transformations, Density slicing

Unit-6: Information extraction- Multispectral classification – Visual interpretation-Digital classification – Unsupervised, supervised; other classifiers –Deep learning methods, Fuzzy logic, Decision tree (basic level); post classification smoothing, Ground truth, accuracy assessment. Object based image classification, difference between per pixel and object based classification. PCA; Image arithmetic, Change detection methods, State of the Art – Geo-AI. Unit-7: Stereo Imagery - DEM Creation methods, examples, comparison and Application

Unit-8: Major applications of remote sensing in Vegetation / Terrestrial ecology/wildlife; Hydrology/Land use / Land cover /Agriculture; Disaster management

Unit-9: Overview of Advanced topics: Drone imagery – Ultra high resolutions (cm level data); Hyperspectral and thermal (near optical); Microwave/Radar

References:
1. Introduction to Remote Sensing by James B. Campbell
2. Remote Sensing and Image Interpretation by Thomas.M.Lillesand
3. Remote sensing Digital Image Analysis by J.A Richards and Xiuping Tia
4. Fundamental of Remote Sensing by CCRS (Online)
5. Principles of Remote Sensing by ITC (online)

5. Teaching-Learning Strategies in brief:
Teaching, discussing current approaches of information extraction, challenges and limitations with satellite data; Current research papers presentations by students on chosen topic; writing assignments, periodical evaluation of course project implemented with open data and tools; applying remote sensing satellite imagery in different domains, develop an open source tool as part of project or revise algorithms for feature extraction or for any image processing method.

6. Assessment methods and weightages in brief:
   1. Assignments [written, lab and presentations] - (20%),
   2. Theory [Mid exams-2 (30%) and End exam (30%)] - (60%)
   3. Project [Literature survey, Preliminary and final presentation along with report] - (20%)

*PROJECT: Development of open source tools, replication of case studies or working on new problem using open data and algorithms or any application or improvement of existing algorithms in processing and feature extraction from satellite data

-----------------------------------------------
Title of the Course: Design of Hydraulic Structures

Faculty Name: Rehana Shaik

Name of the Program : M.Tech in CASE

Course Code : CE5.501
Credits : 
L - T – P :3-1-0
(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring, 2022
(Ex: Spring, 2022)

Pre-Requisites : Basics of fluid mechanics and hydraulics

Course Outcomes :
After completion of this course successfully, the students will be able to

- Develop a detailed understanding about the design aspects of the hydraulic structures those are constructed for the purpose of storage, diversion, conveyance and distribution of water.
- Design various major hydraulic structures such as dams, reservoirs, aqueducts, weirs, canals, etc.
- Understand how basic principles of hydraulics can be used in the design of structures in terms of safety measures, etc.

Course Topics :
(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

- Introduction of Hydraulics: Fluid Properties and Classification, Hydrostatics, Equation of Motion, Continuity Equation, Flow Measurements
- Introduction: Storage, Diversion, Conveyance and Distribution structures
- Gravity Dams: Site selection, Forces, Stability analysis, Modes of Failure
- Reservoirs: Storage Capacity of a Reservoir and Design aspects
- Design of Diversion Works: Weirs and Barrages, Spillways

Preferred Text Books :

Grading Plan :
(The table is only indicative)

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<tr>
<th>Type of Evaluation</th>
<th>Weightage (in %)</th>
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<td>Other Evaluation</td>
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Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

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Teaching-Learning Strategies in brief (4-5 sentences):

Lectures and tutorials to solve various hydraulic structures, practice problems, assignments with real-time case studies and data. Starting from basic hydraulics to design of large structures such as Weirs, dams, canals, aqueducts, spillways, the lectures try to cover diverse topics related to safety and design aspects for the better water resources management.
CO-4: Employ statistical and machine learning algorithms for predicting hydroclimatic processes

CO-5: Develop critical thinking to help in processing data from various sources to solve water related issues using computational algorithms and technologies

CO-6: To improve the problem-solving skills for solving water and climate related problems

Course Topics:

Acquisition and Processing of Hydroinformatics Data: Automated data collection, data storage, file formats and standards, web-based data distribution, access and processing, geographic information system; digital image processing, digital elevation modeling.

Technologies in Hydroinformatics: Regression, Stochastic Models, Optimization, Data Driven Models.

Application of Hydroinformatics: Operation, management and decision making, development of decision support systems for water, agriculture, energy, climate and environment.

Preferred Text Books:

- Introduction to Geographic Information Systems by Kang-Tsung Chang
- Geographical information systems and science by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind
- Lo, C. P., and Albert K. W. Yeung., Concepts and techniques of geographic information systems by C P Lo and Albert K W Yeung

Grading Plan:

(The table is only indicative)

<table>
<thead>
<tr>
<th>Type of Evaluation</th>
<th>Weightage (in %)</th>
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<tr>
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<td>Mid SemExam</td>
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<td><strong>Project</strong></td>
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**Mapping of Course Outcomes to Program Objectives:** (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

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</table>
Teaching-Learning Strategies in brief (4-5 sentences):

Lectures and tutorials to analyze, process, visualize and map various water and climate related information. Hands on sessions and assignments with real-time case studies and data to process and understand hydroinformatics with the use of computer programming skills.

Title of the Course: Earthquake Engineering

Faculty Name: Pradeep Kumar Ramancharla
Name of the Academic Program: M.Tech in Computer Aided Structural Engineering
Course Code: CE1.641
L-T-P : 3-1-0
Credits : 4

1. Prerequisite Course / Knowledge:
B.Tech in Civil Engineering subjects i.e., Engineering Mechanics, Reinforced Concrete Design, Structural Analysis, Structural dynamics

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to:

CO-1  Use the understanding of the earthquake engineering for structural design;
CO-2  Write computer programs, to understand earthquake behaviour;
CO-3  Analyse and design the structure using commercially available software
CO-4  Apply the knowledge of code provisions for design of buildings and structures
CO-5  Appreciate the challenges in construction industry and get equipped to address some of the challenges

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|


4. Detailed Syllabus:

Unit 1: **Earthquake Hazard on Buildings**: Plate tectonics, Origin of earthquakes, types of faults and seismic waves, measurement of earthquakes, magnitude and intensity, characteristics of earthquake ground motion

Unit 2: **Earthquake Behavior and Analysis of Buildings**: Behavior of MRFs, behavior of SWs, Earthquake Analysis of Buildings, methods of Analysis

Unit 3: **Earthquake Resistant Design and Detailing of Buildings**: IS 1893-2016, concept of earthquake resistant design, seismic code Provisions for design of buildings, earthquake Resistant Detailing of Buildings, IS 13920-2016

Unit 4: **Earthquake Safety Assessment of Building**: Pre-earthquake safety assessment, post-earthquake evaluation of structures & Retrofitting

Unit 5: **Earthquake Strengthening of Buildings and Special Topics**: Methods of Retrofitting, Methods of Strengthening, Special topics, non-engineered constructions

Reference Books:

2. Earthquakes by Bruce A. Bolt.
3. Earthquake Engineering, Application to Design by Charles K. Erdey.
4. Earthquake Engineering: From Seismology to Performance Based Design by Yousef Bozorgnia and VitelmoBertero.

5. **Teaching-Learning Strategies in brief** (4 to 5 sentences):
A lecture on a theory concept will be preceded by its practical relevance, appreciation of field level challenges and immediately followed by on-hands-practice using manual approach as well as using appropriate scientific software. Student will be encouraged to come up with issues and how the theory and hands-on experience is helping them. Student is also encouraged to do homework and assignments individually and mini-projects as a group task.

6. **Assessment methods and weightages in brief (4 to 5 sentences):**

The course will rely heavily on looking at problem solving capability of student and hence the assessment is divided as follows i.e..

a) 20% weightage is given to individual assignments for checking the concepts taught in the class,

b) 20% weightage is for group projects for checking software application

c) 30% is quizzes & Mid exam for checking the application of concept and,

d) 30% for end-sem exam is for overall assessment.

Title of the Course: **Environmental Science and Technology**

Faculty Name: Ramachandra Prasad P

Course Code: CS9.428

L-T-P: 3-1-0.

Credits: 4

(L= Lecture hours,
T=Tutorial hours,
P=Practical hours)

**Open Elective (Monsoon) (UG and PG)**

1. **Prerequisite Course / Knowledge:**

Basics Science (Biology, Physics, Chemistry, Earth systems) to understand environmental issues and phenomenon.

2. **Course Outcomes (COs)**

After completion of this course successfully, the students will be able to

CO-1: Understand various environmental issues of concern
3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

<table>
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4. Detailed Syllabus:

Unit-1: Basics of Environmental Science & Technology: Comprehend environment and its issues, Environmental problems and challenges, Environmental Events,

Unit-2: Earth components; Climate Change: Climate system, Climate feedback loops, Climate Models, Climate impact on environment; Global Catastrophes, unexpected climate changes

Unit-3: Role of geospatial technology: in assessing environmental degradation


Unit-5: Environmental Impact Assessment: Procedure, regulations and case studies
Unit 6: Environment and Information technology: Green computation, Green energy, Green Engineering and technology, e-waste-disposal mechanism – impact on health.

Unit 7: Green accounting- Evolution of process, history, case studies, Accounting of goods and Services, Sustainability concepts-weak and strong, Hicksian income concept

Unit 8: Environmental movements

Unit 9: Environmental Legislation & Impact Assessment: Important legislations related to Environment; Environmental Auditing; Environmental Ethics

References:


5. Teaching-Learning Strategies in brief:

Teaching, discussing current environmental issues, presentations by students on chosen topic, writing as well as drawing assignments, periodical evaluation of course project implemented with open data and tools to understand various environmental processes and possible solutions to combat anthropogenic driven environmental degradation and problems.

6. Assessment methods and weightages in brief:

**Theory (%)**: Quiz (10), Assignments (15), Mid exam-1(20), End exam (30) = 75% **Project (%)**: Literature Survey, Preliminary and final presentation along with report = 25%

*PROJECT*: Simulation and modeling of environmental processes, development of open source tools related to environmental problems / applications, replication of case studies or working on new problem using open data and tools.
Title of the Course: Hydrological Modeling and Software Development

Course Code: CE5.502

Faculty Name: Shaik Rehana

L-T-P: 3-1-0.

Credits: 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program: B.Tech. in Computer Science and Engineering Open Elective (Monsoon)

Prerequisite Course / Knowledge:
General awareness about the water and climate related problems and computational programming skills to develop tools for an effective water resources management.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1: Develop awareness about various water and climate change related problems and help to provide best possible optimal solutions for better management of water resources

CO-2: Integrate hydrological models with computational techniques

CO-3: Employ computer science skills in developing hydrological modelling and water management tools

CO-4: Design and develop open-source tools for mapping, analysing and predicting hydrological processes

CO-5: Develop critical thinking to help in solving real-time water related issues using computational algorithms and technologies

CO-6: To improve the problem-solving skills for solving water resources management problems

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

| PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 | PS O4 |
‘3’ in the box denotes ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping

4. Detailed Syllabus:

1. **Introduction**: fundamentals of fluid mechanics and open channel flows; hydrology, rainfall and runoff processes and hydro-climatology, statistical analysis, optimization methods.

2. **Water Resources Systems**: river basin and urban hydrology, river water quality modelling, flood and drought management, irrigation and reservoir operation and climate change.

3. **Technologies and Software**: Open-source public domain software based on Microsoft Windows environment: US Environmental Protection Agency’s Qual2k; Matlab Tools: Air2stream; Windows based decision support systems.

4. **Development and Application of Software**: Real-world applications at various scales for water resources management

References:

4. SK Som and G Biswas, *Introduction to Fluid Mechanics and Fluid Machines*

**Teaching-Learning Strategies in brief:**

Lectures and tutorials on various tools to analyse, visualise and map various water resources
systems such as rivers, basins, catchments, etc. Hands on sessions and term-projects with real-time case studies for understanding water and climate related issues and to develop tools with the use of computer programming skills and open sources software tools.

6. Assessment methods and weightages in brief:

Theory (%): Quiz (10), Assignments (10), Mid exam-1(20), End exam (30) = 70%

Projects (%): Term project and final presentation along with report = 30%

Title of the Course: Advanced Mechanics of Materials and Design
Faculty Name: Venkateswarlu Mandadi

Name of the Program: Electives for PG CASE Students
Course Code: 
Credits: 4
L—T—P: 3-1-0;

Semester, Year: Spring, 2022

1. Prerequisite: Mechanics of Materials
2. Course Outcomes

| CO 1 | Integration of buckling phenomenon with design |
| CO 2 | Learn preliminary design prior to full computational analysis |
| CO 3 | Learn the basic principles of composite structures |
| CO 4 | Understand the basics of structural mechanics and design. |
| CO 5 | Understand the underlying principles of code-based design. |
| CO 6 | Learn methods useful for checking the output from more complex methods |

3. Course Topics

<table>
<thead>
<tr>
<th>Flexure</th>
<th>von Mises yield criterion, Elastic section modulus, Plastic section modulus, Moment curvature relation, Unsymmetrical bending, Shear</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Strength, Bending strength, Bending moment capacity in the presence of shear forces</td>
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<td>Torsion</td>
<td>Saint-Venant torsion theory, Prandtl stress function, Membrane analogy, Lateral torsional buckling, Elastic critical buckling moment</td>
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<td>Arches</td>
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<td>Composite Structures</td>
<td>Shear studs, Effective width, Serviceability limit state design, ULS bending strength, Elastic design of shear studs, Plastic design of shear studs</td>
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4. Preferred Text Books: Cook, R. D., Advanced Mechanics of Materials
   Spiegel, P. E., Applied Structural Steel Design

5. Reference Books:
   Boresi, A. P., Advanced Mechanics of Materials McCormac, J. C., Structural Steel Design

6. Grading Plan

<table>
<thead>
<tr>
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8. Teaching-Learning Strategies

Lectures in class room, weekly tutorials on problem solving, active learning by students.