SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Master of Technology
Structural Engineering

M. Tech. I Semester I

Subject Name: Introduction to Wind and Earthquake Engineering **Subject Code:** MTST14105

Type of course: PE - II
Prerequisite: Fluid Mechanics, Mechanics of Solids, Structural Analysis, Soil Mechanics
Rationale: Day by Day, due to scarcity of land, it has become compulsory to go for vertical expansion than the horizontal expansion of building. The buildings are becoming taller and thinner. Also, due to development of lightweight materials, buildings have become lighter in weight. These all revolutions increase the responsibilities of structural engineer as structures become more sensitive to earthquake and wind loading. This course gives basic introduction to effect of wind and earthquake on civil engineering structures.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course.

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Introduction to Wind Engineering:** Overview of Atmosphere and Atmospheric Boundary Layer– Atmospheric Circulation, Effect of Friction, Topographic Effects, Governing Equations, Mean Velocity Profiles, Power Law, Logarithmic Law, Gust Factor, Peak Factor, Important Criteria in designing for Wind, Nature of Wind, Type of Wind, Characteristics of Wind	05	10%
2	**Bluff Body Aerodynamics:** General Characteristics of Fluids and their motion, Equations of Fluid Motion, Boundary Layers, Aerodynamic Loads on Bodies, Effect of Turbulence on Bluff Body Aerodynamics, Maximum Surface Pressure and response of large structures, Interference Effects	10	20%
3	**Wind Induced Vibrations of Tall Buildings:** Types of Flow Induced Excitation, Vortex Induced Vibrations, Lock-in Phenomenon, Buffeting and Ovalling, Galloping and Flutter	05	10%
4	**Experimental Approach:** Wind Tunnel Engineering – Conditions to satisfy for Proper Conduct of Wind Tunnel Tests, Wind Tunnel Test Models, Pedestrian Wind Studies, Introduction to Computational Fluid Dynamics – Size of Computational Domain, Types of Mesh, Boundary Conditions, Various Turbulence Model, Methods of Discretization, Codal Provisions, Design Wind Velocities, Wind Resistant Design- Indian Codes	05	10%

PE - II: Programme Elective - II

5	**Introduction to Earthquake Engineering:** Seismology – Internal Structure of Earth, Continental Drift and Plate Tectonics, Movement of Plate Boundaries, Faults, Elastic Rebound Theory, Earthquake, Earthquake Waves, Earthquake Terminologies, Recording Earthquakes, Ground Motion Characteristics	**08**	**20%**
6	**Behavior Study Structures during Earthquake and their earthquake resistance features:** Building Behavior – Influence of Soil, Damping, Building Motions & Deflections, Building Drift, Seismic Design Concept – Structural Response, Load Path, Demands of Earthquake Motions, Response of Elements attached to Building, Adjacent Buildings, Irregular Buildings, Lateral Force Resisting Systems, Diaphragms, Ductility, Damage Control Features, Continuous Load Path, Redundancy, Configuration, Dynamic Analysis – Response Spectrum Method and Time History Method, Codal Provisions – IS 1893	**12**	**30%**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**25**	**25**	**10**	**10**	**10**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of Publication	Publication Edition
01	Dynamics of Structures	Clough R. W. and Penzien J	McGraw Hill	1995	3rd Edition
02	Earthquake Resistant Design of Structures	Pankaj Agarwal and Manish Shrikhande	PHI Learning Pvt. Ltd. 978-8120328921	2011	1st Edition
03	Structural Dynamics and Introduction to Earthquake Engineering	Chopra A. K.	Prentice Hall	2012	4th Edition
04	Advanced Structural Wind Engineering	Yukio Tamura andAhsan Kareem	Springer	2013	1st Edition
05	Wind and Earthquake Resistant Buildings	Taranath B. S.	Marcel Dekker 0-8247-5934-6	2004	1st Edition
06	Wind Effects on Buildings: Design applications	Lawson T. V.	Applied Science Publishers	2011	1st Edition
07	Wind Effects on Structures	E. Simiu and R.H. Scanlan	Wiley	1996	1st Edition

PE - II: Programme Elective - II

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % Weightage
CO-1	Understand the fundamentals of Wind Engineering *(R, U – Cognitive Level)*	20%
CO-2	Understand the response of Building against action of Wind and different experimental techniques to evaluate the response *(U, A, N, E, C – Cognitive Level)*	15%
CO-3	Understand experimental techniques to evaluate the response of structure to wind *(U, A, N, E, C – Cognitive Level)*	15%
CO-4	Understand the Basics of Earthquake Engineering *(R, U – Cognitive Level)*	20%
CO-5	Understand the behavior of different types of building during occurrence of earthquake and their earthquake resistant features *(U, A, N, E, C – Cognitive Level)*	30%

FOR TUTORIAL SESSIONS:

List of Tasks:

- Group of Students have to prepare presentation based on topics of subject as well as individually students have to write / solve assignments.

List of Open Source/learning website:

- https://nptel.ac.in/courses/105/101/105101004/
  - Lecture Series on Introduction of Earthquake Engineering by Dr. R. S. Jangid, IIT Bombay.
- www.nicee.org
  - National Information Centre for Earthquake Engineering, IIT Kanpur.
- www.eeri.org
  - Earthquake Engineering Research Institute
- https://www.simscale.com/wind-engineering/
  - Wind Analysis Software