SARVAJANIK UNIVERSITY
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SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology
Civil Engineering

B. Tech. IV Semester VII

Subject Name : Basic Structural Dynamics **Subject Code:** BTCL14707
Type of course : PEC - V
Prerequisite : Engineering Mechanics (BTCL12113), Theory of Structures (BTCL13305), Structural Analysis (BTCL13404), Basic Concrete Design (BTCL13502)
Rationale : During the lifespan of any structure, there is every chance of its subjection to Earthquake, wind, traffic, blasting, Machine Vibration etc. load condition which is known to be time dependent forces. These forces causes vibrations in structures and hence it is important to study structural dynamics course which will help understanding the behavior of structure under such dynamic loading condition and to arrive at safe design solutions for Civil Engineering Structures.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	0	3	60	25	15	-	-	100

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:** Overview of Structural Dynamics, Basic terminology – Natural Frequency, Natural Period, Resonance etc, Types of Analysis, Degrees of Freedom, Assumption to reduce dynamic DoF, Mathematical modeling of dynamic systems, Springs in Parallel & in Series, D'Alembert's Principle	8	15%
2	**Single Degree of Freedom System:** Equation of Motion for Free vibration without damping, Logarithmic Decrement, Problem Solutions	10	25%
3	**Multi Degree of Freedom System:** Equation of Motion for Free vibration with damping, Transmissibility, Problems Solutions	10	25%

PEC - V: Professional Elective Course - V

4	**Basics of Earthquake and Wind Engineering:** Earthquake Terminologies, Seismic Waves, Seismographs, Magnitude and Intensity, Seismic Zones of India, Effects of Earthquake, 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, Types of Flow Induced Excitation, Vortex Induced Vibrations, Buffeting and Ovalling, Galloping and Flutter	10	25%
5	**Special Topics (Concept Only):** Vibrations caused by Construction, Demolition, High Speed Traffic, Blasting and Pile driving, Machine Foundation	7	10%

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	25	25	15	15	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
02	Structural Dynamics - Theory and Computation	Paz Mario	CBS Publication	2004	2nd
03	Structural Dynamics and Introduction to Earthquake Engineering	Chopra A. K.	Prentice Hall	2012	4th
04	Structural Dynamics – Vibrations and Systems	Madhujit Mukhopadhyay	Ane Books Pvt. Ltd.	2006	1st
05	Dynamics of Structures	Humar J. L	Prentice Hall	2012	3rd
06	Advanced Structural Wind Engineering	Yukio Tamura and Ahsan Kareem	Springer	2013	1st
07	Wind and Earthquake Resistant Buildings	Taranath B. S.	Marcel Dekker 0-8247-5934-6	2004	1st
08	Wind Effects on Buildings: Design applications	Lawson T. V.	Applied Science Publishers	2011	1st
09	Wind Effects on Structures	E. Simiu and R.H. Scanlan	Wiley	1996	1st

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Demonstrate the differences between Static and Dynamic Load System acting on structures and its relative effects on structures *(R, U - Cognitive level)*	15%
CO-2	Explain and analyze the dynamic response of single degree freedom system using fundamental theory *(R, U, N, A, E, C - Cognitive level)*	40%
CO-3	Explain and analyze the dynamic response of structures under Dynamic Load Conditions like Wind and Earthquake *(R, U, N, A, E, C - Cognitive level)*	30%
CO-4	Implement the fundamentals of Vibrations caused by Blast and High Speed Traffic, Construction, Demolition, Machine Foundation *(R, U, N, A, E, C - Cognitive level)*	15%

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	-	-	2	1	-	-	3	-	-	-	3	2	1	1
CO-2	3	3	2	2	1	2	1	3	1	-	-	3	2	1	1
CO-3	3	3	2	2	1	2	1	3	1	-	-	3	2	1	1
CO-4	3	2	2	2	1	2	1	3	1	-	-	3	2	1	1
Rationale*	12	8	6	8	4	6	3	12	3	-	-	12	8	4	4

Rationale*: Most of the COs are matching with POs. It helps the engineers to analyse the structures for all types of dynamic loads like earthquake, machine vibrations etc.

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/105/104/105104189/
  - Lecture Series on Structural Dynamics by Prof. Riya George, IIT Kanpur
- https://nptel.ac.in/courses/105/106/105106151/
  - Lecture Series on Structural Dynamics by Prof. R. Pradeep Kumar, IIIT Hyderabad
- 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

List of Open Source Software:

- https://sd-iiith.vlabs.ac.in/