BIRLA INSTITUTE OF TECHONOLOGY AND SCIENCE, PILANI
Pilani Campus

INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017
Course Handout Part-II

Date: 3/8/2016

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **CE G551**
Course Title : **DYNAMICS OF STRUCTURES**
Instructor-in-charge : **D. BHUNIA**

Scope and Objective of the Course:
Natural phenomena and human activities impose forces of time-dependent variability on various civil engineering structures. This course deals with analysis and design of structures subjected to dynamic loads which involve consideration of time-dependent forces.
Therefore, this course is necessary for students desirous of joining design offices/ industry related to buildings, industrial plants, bridges, tanks, offshore structure, tall chimneys etc. At the end of the course work students will be able to determine the behavious of structures under dynamic loading and design a structure which is resistant to dynamic loading such as seismic, wind, seawave, vehicle induced vibration force etc.

Text Book (T):
T1. Anil K. Chopra, "Dynamics of Structures: Theory and applications to earthquake engineering", Prentice Hall India Ltd., 2007.

Reference Books (R):
R1. R.W. Clough and J. Penzien, "Dynamics of Structures", McGraw Hill International edition, 1993.
R2. Mukhopadhyay,M., "Structural Dynamics: Vibrations & Systems" Ane Books Pvt. Ltd., 2006.
R3. Paz,M., "Structural Dynamics: Theory & Computation" CBS Publishers & Distributors, 2001.

Course Plan (Total of 42 lectures)

Lec. No.	Learning Objective	Topics to be covered	Ref. to Ch
1	Importance of the course	Introduction and Scope of dynamic analysis of structures; origins of vibration theory and experiment; review of earlier concepts: d'Alembert's principle, equations of motion.	T1-1, R2,R3
2-5	Fundamentals of Dynamics of Structures	Elements of a structural system: springs, dashpot, mass; Springs in parallel and series; methods to formulate equations of motion:	T1-1,2, R2,R3
6-10	Free vibration analysis of S.D.O.F system	Formulation (equation of motion) and solution of undamped and damped free vibration analysis of S.D.O.F system.	T1-2, R2,R3
11-14	Forced vibration analysis of S.D.O.F system	Formulation (equation of motion) and solution of undamped and damped forced vibration analysis of S.D.O.F system.	T1-3, R2,R3
15-18	Forced vibration analysis (evaluation of response to general dynamic loading)	Forced vibration under harmonic, periodic, impulse, step, ramp, general dynamic forces (time and frequency domain analysis) and response spectrum load, support excited vibration, seismic pickups.	T1-4, 6,7, R2,R3
19-24	Numerical methods for free and forced vibration analysis (evaluation of	Numerical techniques for evaluation of dynamic response of SDOF system; time domain analysis; direct integration techniques; finite difference method (Central Difference method); Newmark beta method;	T1-5, R2,R3

	dynamic response)	average and linear acceleration method.	
25-27	Analysis of two degree of freedom	Development of equation of motion and solution for two degree of freedom systems.	T1-9, 11, R2,R3
28-31	Free vibration (Eigen value) analysis of lumped MDOF systems	Free vibration analysis of MDOF systems; frequencies; mode shapes and response; orthogonality condition of mode shapes;	R1-11,13, R2,R3
32-37	Method of solving Eigen value problems	Approximate methods for obtaining natural frequencies and mode shapes; Holzer method; Stodola's method; Rayleigh's method; Rayleigh-Ritz method; Inverse iteration method; Vector iteration method; Rayleigh's Quotient iteration method; Matrix iteration method.	R1-13, R2,R3
38-42	Forced vibration analysis of MDOF systems	Generation of damping matrix for MDOF; dynamic properties; modal damping; classical damping; damped response with Rayleigh and Caughey damping.Mode superposition method; mode acceleration method; modal combination rules using absolute sum, SRSS and CQC method. Response Spectrum, continuous system.	R1-12, R2,R3

Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Remarks
Mid-semester	90 min	40%	<TEST_1>	CB
Take Home Assignments, Projects including Seminar	-	5%+10%	**Continuous**	OB
Comprehensive Examination	3 hrs	45%	<TEST_C>	OB

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- **Chamber Consultation Hour:** To be announced in the class.
- **Notices:** Notices will be displayed on the Civil Engineering Dept. Notice Board only.
- **Make-up Policy:**. Make-up will be granted on a case by case basis only on genuine reasons.

Instructor-in-charge