



Date:01/08/2016

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 Code: ME F413

Name of the Course: Nonlinear vibrations

Instructor-In-Charge: Amol Marathe

I. Textbook

1. Richard Rand, "Lecture notes in nonlinear vibrations" version 52
Download link: <http://www.tam.cornell.edu/randdocs/>
2. Lecture notes

II. Course Contents

Topic	Number of Lectures	Source
1. Introduction through examples: Curves 1.1 simple and inverted pendulum, EoM of 6 dof rigid body 1.2 Duffing and van der Pol oscillators 1.3 Parametrically excited nonlinear systems	15 = 4+2+2+2+5	TB1 & TB2





1.4 Dynamical systems point of view: phase plane analysis, separatrices, centres, saddles, ode45, pplane8 etc.		
1.5 Perturbation methods: Uniform expansion, secular terms, method of multiple scales, Lindsteadt-Poincare' method, roots of polynomials, radius of a limit cycle		
2. Externally forced Nonlinear systems: 2.1 Amplitude dependent time period & natural frequency 2.2 Nonlinear frequency response using harmonic balance and continuation methods 2.3 Poincare' map, jump phenomenon, multiple steady state solutions, backbone curve	$7 = 2+3+2$	TB1 and TB2
3. Parametrically forced systems: 3.1 Parametric roll of ships, natural roll period 3.2 Floquet theory, subharmonic resonances 3.3 Mathieu and Hill' s equations, stability diagram	$7 = 1+3+3$	TB1
5. Self-excited systems: 5.1 van der Pol oscillator, relaxation	$5 = 2+3$	TB1





oscillator		
5.2 Entrainment		
5. Chaotic systems		
5.1 Lyapunov exponents		
5.2 Melnikov analysis	8=2+2+2+2	TB2
5.3 Lorenz system & logistic map		
5.4 Bifurcation diagram, fractals etc.		
Total	42	

IV. Evaluation Scheme and Schedule

Component	%Weightage	Date	Type	Remarks
Midsem Examination	25	<TEST _1>	Open book	
Assignments	20	–		
Quiz	20			
Endsem Examination	35	<TEST _C>	Open book	





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Pilani Campus
Instruction Division

V. **Chamber Consultation Hour:** It will be announced in the first class.

VI. **Notices concerning the course:** Nalanda or/and personal communication

VII. **Make-up Policy:** Make up for any component of evaluation will be permitted only in genuinely serious cases only after production of necessary medical certificates and with prior permission.

Instructor-In-Charge

Amol M. Marathe

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