Vibration of Structures (ME60428)

Term Project (20 Marks)

Problem 1

1. Analytically derive the **first four** *natural frequencies* and *mode shapes* of a uniform *Euler-Bernoulli cantilever beam* undergoing transverse vibration. (dimensions given below)
2. Determine the **first four** *natural frequencies* and *mode shapes* of the same beam using **Ritz method** with a *10-term approximation*. Plot the mode shapes and compare them with the exact mode shapes in four separate plots.
3. Determine the first four natural frequencies and transverse bending modes of the same beam using Ansys.

Problem 2

1. Analytically derive the **first six** *natural frequencies* and *mode shapes* of a uniform *Kirchhoff rectangular plate with simply supported edges* undergoing transverse vibration. (dimensions given below)
2. Determine the **first six** *natural frequencies* and *mode shapes* of the same plate using Ansys.

Note the following points:

1. Please submit the project report by **1st May, 2024 (Wednesday)** to Mr. Ravi Prakash Prajapati.
2. The report should contain the following:
    a. Neat figures with proper dimensions and material properties. (given below)
    b. Handwritten derivation of the analytical eigenfunctions and eigenfrequencies.
    c. Print out of computer codes showing the results.
    d. Ansys results and discussions.
    e. Tables comparing the first four natural frequencies from analytical, numerical and software (Project 1), and analytical & software (Project 2).
3. Record a video (max 5-6 mins) and discuss the steps you used for the modal analysis in Ansys workbench, and show the animations for the required mode shapes. Upload the recorded video in YouTube/Google Drive and share the link in the Teams assignment within the stipulated deadline.

Helpful Resources:

1. Link to download Ansys: http://swrepo.iitkgp.ac.in/ (download the version suitable for your laptop configurations)
2. Beam Analysis Tutorial: https://www.youtube.com/watch?v=NpVX-C2d2Ks
3. Plate Ansys Tutorial: https://youtu.be/4Ee6DNkHyc0?si=O9liGhboOmlQ9keP

Dimensions:

Beam - 1 m x 50 mm x 25 mm (length, breadth, height)
Plate - 2 m x 1 m x 10 mm (length, breadth, height)

Roll No	Name	E (GPa)	ρ (kg/m^3)	ν
19ME33007	Shaikh Mohammed Farman	50	5500	0.33
20ME33002	Mohammed Sinan P K	55	5400	0.33
20ME33003	Preya Singh	60	5300	0.33
20ME33004	Swasti Singh	65	5200	0.33
20ME33006	Shreesh Mahapatra	70	5100	0.33
20ME33007	Devadath K	75	5000	0.33
20ME33008	Soumya Ranjan Sahoo	80	4900	0.33
22ME63R20	Ankit Kumar R Sharma	85	4800	0.33
23AE60R06	Keshava Murthy M	90	4700	0.33
23AE60R10	Janakiram Saikiran R	95	4600	0.33
23AE60R13	Rahul Chandan Chauhan	100	4500	0.33
23AE60R15	Rajesh Sahoo	105	4400	0.33
23AE60R19	Harsh Verma	110	4300	0.33
23AE60R21	Vasanthakumar C	115	4200	0.33
23ME63R05	Jyoti Prakash Panigrahi	120	4100	0.33
23ME63R06	Kantha Rao Cherlopalle	125	4000	0.33
23ME63R07	Piyush Kumar Nirmal	130	3900	0.33
23ME63R10	Kothipaka Nithin Swaroop	135	3800	0.33
23ME63R11	Mungekar Gaurav Bholanath Madhavi	140	3700	0.33
23ME63R13	Mohol Ashutosh Ravindra Sharmila	145	3600	0.33
23ME63R14	Rohit A	150	3500	0.33
23ME63R16	Adrish Datta	155	3400	0.33
23ME63R17	Nandikolla Ramadurga Subrahmanyeswara Raja	160	3300	0.33
23ME63R18	Rohit R Nair	165	3200	0.33
23ME63R19	Dandecha Harshit Meghjibhai	170	3100	0.33
23ME63R20	Mesenene Kiran	175	3000	0.33
23ME63R21	Abhishek Tiwari	180	2900	0.33
23ME63R22	Sasubilli Jagadeesh	185	2800	0.33
23ME63R24	Navin Pranjal	190	2700	0.33
23ME63R25	Jammu Sarath	195	2600	0.33
23ME63R26	Rajdeep Chatterjee	200	2500	0.33
23ME63R27	Abhishek. K. Sasi	205	2400	0.33
23ME63R28	Rwik Nag Biswas	210	2300	0.33
23ME63R29	B Jatin Sai	215	2200	0.33
23ME63R31	Trishul Gorai	220	2100	0.33
23ME63R32	Yogeeraj Chandrakar	225	2000	0.33
23ME63R33	Somnath Chattopadhyay	230	1900	0.33
23ME63R34	Aaditi Kumari	235	1800	0.33
23ME63R38	Nikhil Kirodiwal	240	1700	0.33
23ME63R40	Mukesh Kumar	245	1600	0.33
23ME63R42	Avinash Nagar	250	1500	0.33
23ME63R44	Prabhat Kumar	255	1400	0.33
23ME63R46	Tejas Chhaban Nikam	260	1300	0.33
23ME63R48	Pulastya Bhattacharyya	265	1200	0.33
23ME91R09	Nitin Kumar Aman	270	1100	0.33
23ME91R13	Sahin Reja	275	1000	0.33