Department of Mechanical Engineering, IIT Delhi
Major: MCL 731 Analytical Dynamics

Instructor	S.K. Saha		
Venue	LH 318	Marks	40
Date	Nov. 19, 2017 Sunday	Duration	10:30-12:30 (2 hours)

Instructions

- *Don't keep mobile with you. Keep in the front;*
- *Don't share calculator, Pencil, Compass, etc.*
- *Don't ask anything about the question paper (Do whatever you feel best!)*

*Show your I-card when signing the attendance sheet*

1. Answer the following:

   [5 × 3 = 15]

   a) What is Euler-Bernouli beam?
   b) How Geometric Theory helps an analyst? Define Focus and Center with sketches.
   c) Define generalized coordinates, and correlate degrees of freedom with constraints.
   d) Mention three characteristics of a rotational transformation represented by a 3×3 matrix.
   e) Define virtual displacement, state the Virtual Work Principle, and what is its purpose?

2. For the 2-link system shown below, each massless link of length l is coupled to its previous link at 1 and 2. The mass m of each link is assumed to be concentrated at its end, i.e., at 2 and 3. Derive the equations of motion using Lagrange's formulation.

   [10]
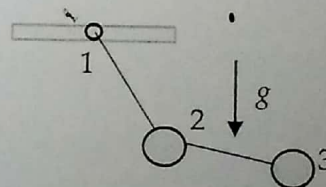
3. Write the equations of motion of a continuous beam under bending using Hamilton's principle. Write the appropriate assumptions. Find the expression for its mode shapes.   [15]

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