INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date .....FN / AN Time: 2 Hrs. Full Marks: 30 No. of Students: 160
Mid Semester Examination Deptt.: Mechanical Engineering
Sub. Name: Systems and Control. Sub. No.: ME 40601
4th Yr. B. Tech. (H) / B. Arch. (H) / M. Sc. / M. Tech. (Duel)

Instructions : Attempt any 4 (Four) questions. Questions carry equal marks.

1Q) Draw a bond graph model of the system shown in *Fig. 1*. Power direct the graph as per the positivities of displacements as marked and taking stretching as positive deformations for all the compliant and dissipative elements. Causal the graph. What are the state variables of the system as per the bond graph model?

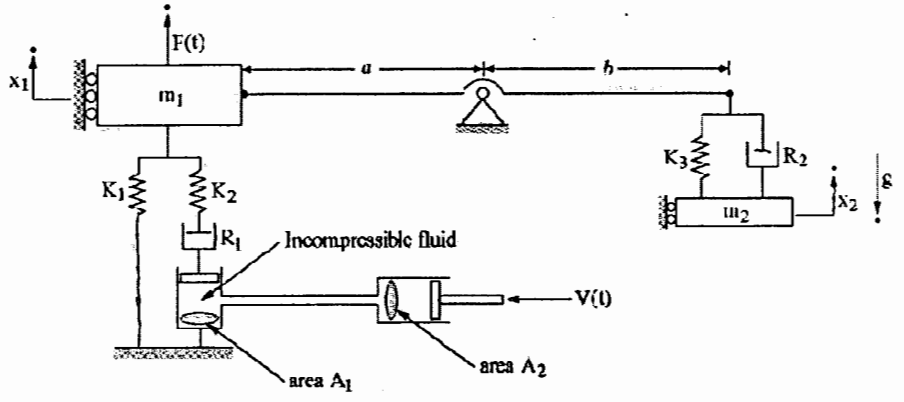


Fig. 1

2Q) Draw bond graph model for the system shown in *Fig. 2*. Reduce the graph such that there is no junction loop or differential causality. Augment the graph and derive equation of motion, for small oscillation.

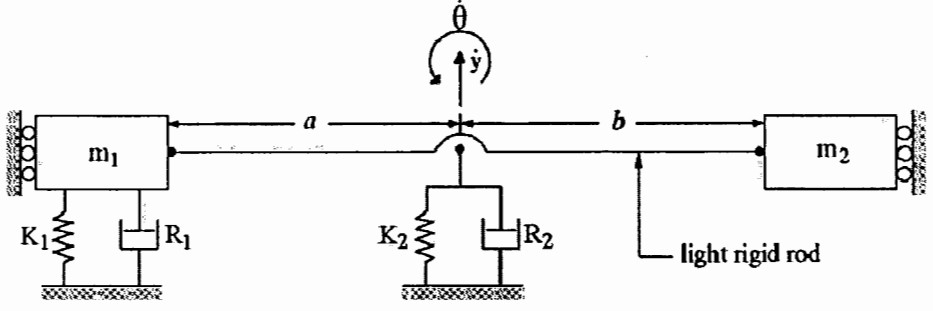


Fig. 2

3Q) Derive the equations of motion for the system shown in *Fig. 3* from its bond graph model.

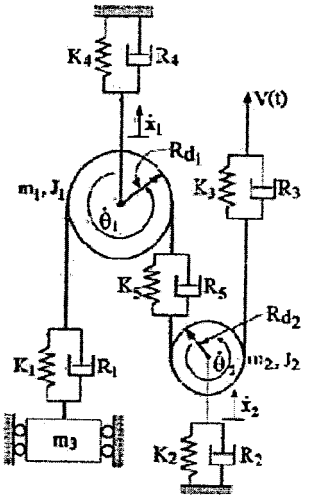
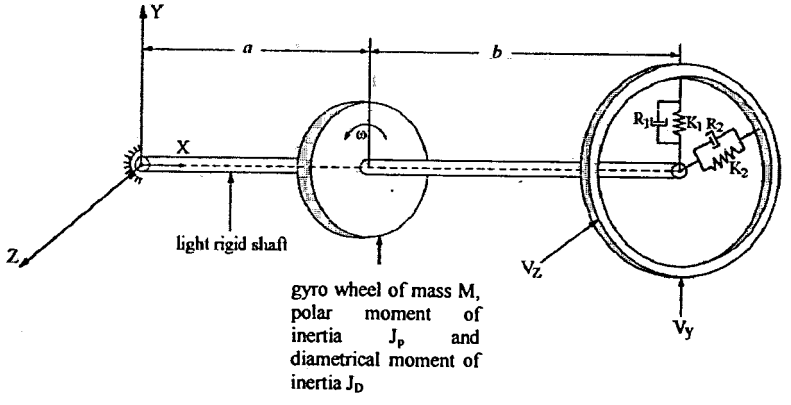


Fig. 3

4Q) A simple model of a gyrocompass is shown in *Fig. 4*. Derive the equations of motion of the system through its bond graph model.



5Q) Create bond graph model of a truck carrying a fly wheel is shown in *Fig. 5*. Just assume the system as a bicycle model. For motor $\tau = \mu i$.

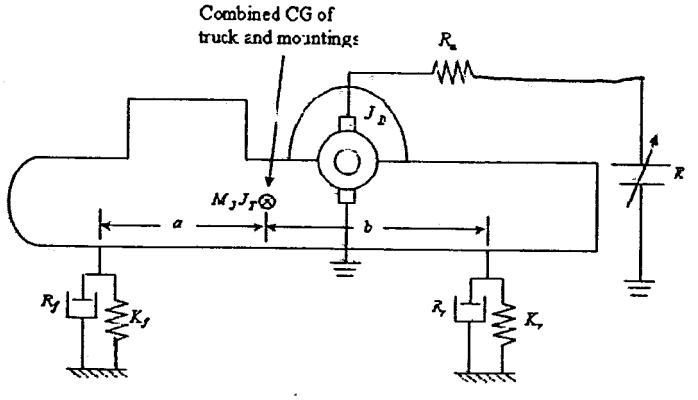


Fig. 5

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