Name:

Enrolment No:

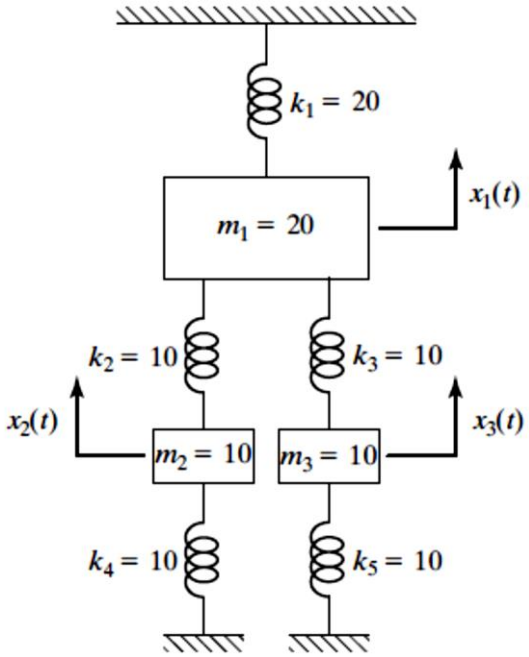
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

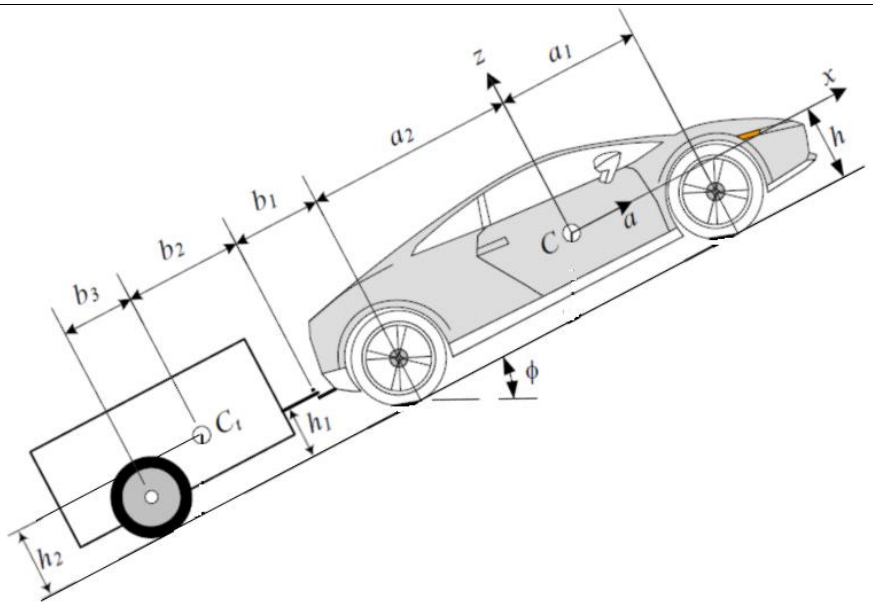
Course: Vehicle Dynamics **Semester: 5th**
Program: B.Tech ADE **Time : 03 hrs.**
Course Code: MEAD3001 **Max. Marks: 100**

Instructions: Attempt all questions. Assume appropriate data if required.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain critical damping and give some examples where it is used.	**4**	**CO1**
Q 2	Explain understeer and oversteer condition.	**4**	**CO1**
Q 3	Describe rolling resistance.	**4**	**CO1**
Q 4	Describe the tread patterns for different road conditions.	**4**	**CO1**
Q 5	Find the tire height and diameter for the following tire: 480/80R46 155A8	**4**	**CO1**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Derive the expression for the effective radius of a tire. **OR** Derive the expression of space requirement for a cornering vehicle with front wheel steering.	**10**	**CO2**
Q 7	Explain the roll center of a vehicle and derive the expression of roll stiffness.	**10**	**CO1**
Q 8	Derive the expressions for force generation in pure lateral slip.	**10**	**CO2**

Q 9	Determine the lowest natural frequency of the system shown in figure,  	**10**	**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	Honda CR-VT M is a midsize SUV car with the following specifications. *m = 1550 kg* *l = 2620 mm* Assume $a_1 = a_2$, *h = 720 mm*, $\mu = 0.8$ The car is accelerating while travelling uphill (slope = 10^o), determine the maximum acceleration of the car if (a) the car is rear-wheel drive (b) the car is front-wheel drive (c) the car is four-wheel drive. Also determine the time taken for the car to reach 0-100 km/h. **OR** Find the tire forces for a rear-wheel-drive car pulling a trailer with the following characteristics: l = 2272mm, w = 1457mm, h = 230mm, $a_1 = a_2$, h_1 = 310mm, b_1 = 680mm, b_2 = 610mm, b_3 = 120mm, h_2 = 560mm, m = 1500 kg, m_t = 150 kg, μ = 1, φ = 10deg, a = 1m/s^2.	**20**	**CO3**

			
Q 11	Derive the equations of motion of a car taking a corner using bicycle model. Also, discuss the stability of the car with following specifications taking a corner at 10 m/s, Cornering stiffness of front tires = 500 N/deg Cornering stiffness of rear tires = 400 N/deg Mass of the car = 900 kg Mass moment of inertia of yaw = 1128 kgm^2 Distance of CG from front wheel = 91 cm Distance of CG from rear wheel = 164 cm State whether the car is in understeer or oversteer condition.	**20**	**CO3**