Name: Enrolment No:	UPES

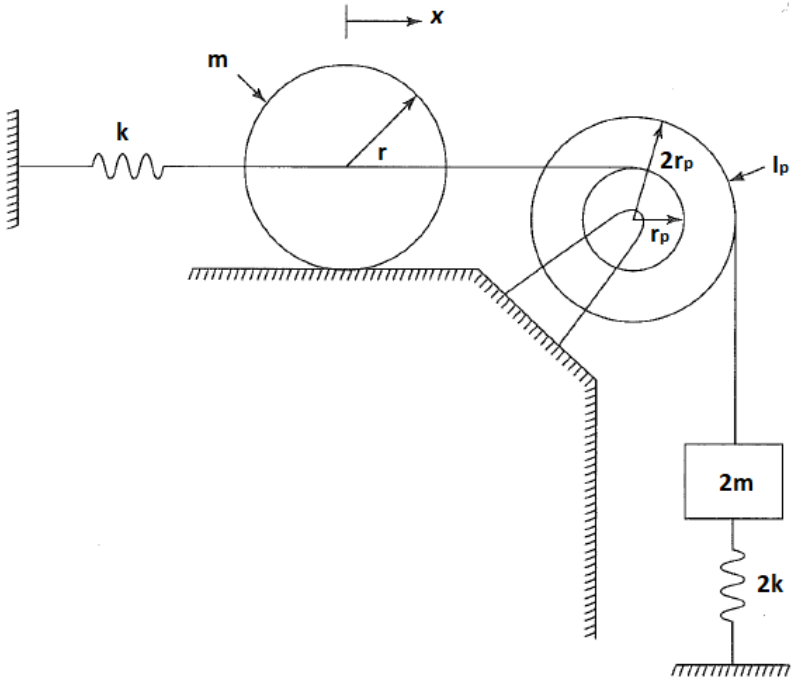
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2020

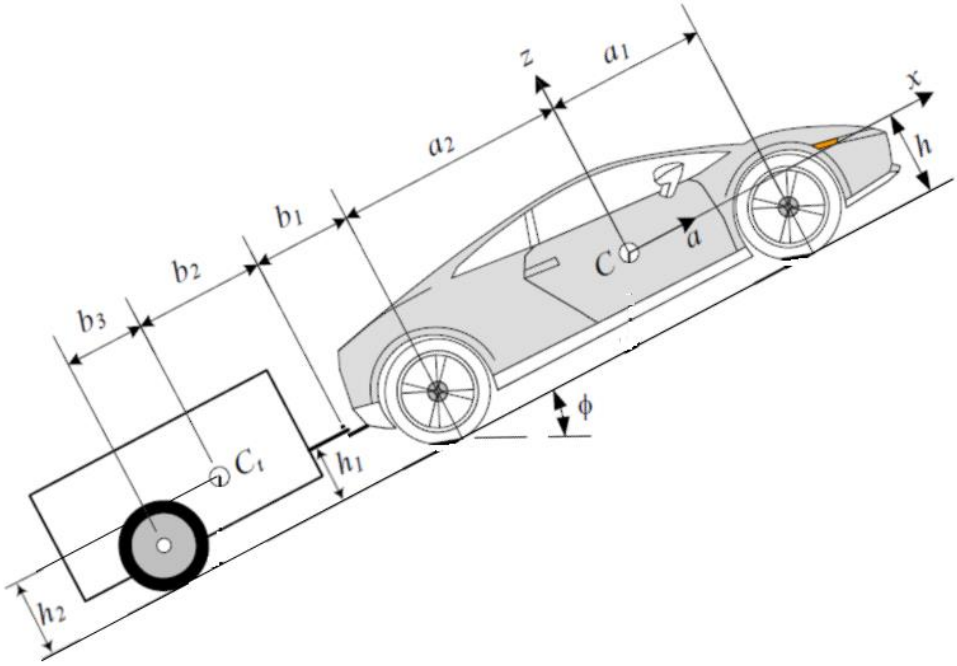
Course: Vehicle Dynamics **Semester: V**
Course Code: MEAD3001/ADEG364 **Time: 03 hrs.**
Program: B.Tech-ADE **Max. Marks: 100**

SECTION A

S. No.	Question Statement	Marks	CO
Q 1	Explain critical damping and give some examples where it is used.	5	CO1
Q 2	Describe the tilting angle of a vehicle moving uphill.	5	CO2
Q 3	Differentiate between radial-ply tires and bias-ply tires.	5	CO3
Q 4	Describe anti-lock braking system (ABS).	5	CO2
Q 5	List out the sources of noise and vibration in a vehicle.	5	CO5
Q 6	Explain the Ackerman condition for low speed turning.	5	CO4

SECTION B

Q 7	Determine the equivalent stiffness and mass matrix of the system shown in Figure when *x*, the displacement of disc measured from equilibrium is used as generalized coordinates. Assume the disk is thin and rolls without slip. 	10	CO1

Q 8	Discuss the effect of changing grip coefficient on the braking performance of a vehicle.	**10**	**CO2**
Q 9	Use the tire brush model to prove that for pure lateral slip, $= 1 - \theta_y \tan\alpha$.	**10**	**CO3**
Q 10	Determine the pitch and bounce frequencies of an automobile with the following data, Mass (m) = 1000 kg Radius of gyration (r) = 0.9 m Distance between front axle and C.G. = 1.0 m Distance between rear axle and C.G. = 1.5 m Front spring stiffness (k_f) = 18 kN/m Rear spring stiffness (k_r) = 22 kN/m	**10**	**CO5**
Q 11	Discuss in detail the understeer and oversteer conditions.	**10**	**CO4**
	SECTION-C		
Q 12	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. Find the tire forces and the maximum angle of acceleration.  	**20**	**CO6**
	OR		
	Derive the expression of lateral acceleration using the enhanced rollover model and calculate the same for a vehicle with m = 13000 kg, the radial stiffness of tire C_R = 800000 N/m, the rolling stiffness k_φ = 127.53 kN-m, w = 2 m, h_1 =0.8 m and h_2 = 1.0 m.		