Name:

Enrolment No:

UPES
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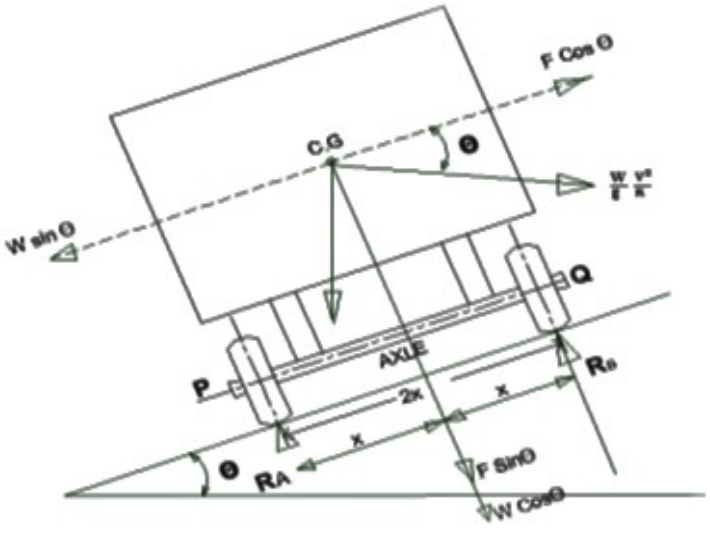
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Automotive Chassis Components Design — **Semester: VI**
Program: B.tech / ADE — **Time 03 hrs.**
Course Code: ADEG 207 — **Max. Marks: 100**

Instructions: ***Assume suitable dimensions if any missing data and Justify for it.***

SECTION-A
(Answer all the questions.)

S. No.		**Marks**	**CO**
Q 1	Define the term nipping of leaf spring, Discuss its role and list the materials commonly used for the manufacture the leaf springs.	**4**	**CO 2**
Q 2	Derive an expression for torque transmitting capacity of a cone clutch using both Uniform pressure and Uniform wear conditions.	**4**	**CO 3**
Q 3	State the different forces and the reactions acting on steering knuckle when the vehicle is at rest.	**4**	**CO 6**
Q 4	Draw the steering linkages for vehicle with rigid axle suspension system.	**4**	**CO 5**
Q 5	Define critical speed of propeller shaft and mention the formula to find the design torque for the shaft.	**4**	**CO 6**
	SECTION-B		
Q 6	A centrifugal friction clutch has a driving member consisting of a spider carrying four shoes, which are kept from contact with the clutch case by means of flat springs until increase of centrifugal force overcomes the resistance of the springs and power is transmitted by the friction between the shoes and the case. Determine the necessary mass and size of each shoe if 22.5 kW is to be transmitted at 750 r.p.m. with engagement beginning at 75% of the running speed. The inside diameter of the drum is 300 mm and radial distance of the center of gravity of each shoe from the shaft axis is 125 mm. Assume $\mu = 0.25$ (Or) A soft surface cone clutch transmits a torque of 200 N-m and 1250 r.p.m. The larger diameter of the clutch is 350 mm. The cone pitch angle is 7.5^{o} and the face width is 65	**10**	**CO 4**

	mm. If the coefficient of friction is 0.2 and find: a) The axial force required to transmit the torque b) The axial force required to engage the clutch c) The average normal pressure on the contact surfaces when the maximum torque is being transmitted and d) The maximum normal pressure assuming uniform wear.		
Q 7	Design a suitable I section for front axle based on following data: The total weight of vehicle is 2700 kgf The total load taken by front axle is 52% Width of the track is 280 cm The distance between the center of the spring pad is 132 cm. Assume a working stress of 915 kgf/cm^2	**10**	**CO 6**
Q 8	A Hooke's joint connects two shafts, the axles of which intersect but are inclined at 20^o to each other. If the driving shaft has a uniform speed of 1000 r.p.m. Find the first principles, the variation in speed of the driven shaft. The driven shaft carries a rotating mass which weighs 147 N and has a radius of gyration of 0.25 m. Find the accelerating torque on the driven shaft for the position when the driven shaft has turned 45^o from the position in which its fork end is in the plane containing the two shafts.	**10**	**CO 6**
Q 9	A four wheeled trolley of total weight 20 kN running on rails of 1 m gauge rounds a curve of 30 m at 40 km/ hr. on a track of embankment slope of 10^o. The wheels have external diameter of 0.6 m and each pair of axle weighs 2000 N and has a radius of gyration of 0.25 m. The height of the C.G of trolley above the wheel is 1 m. Calculate the reaction on the each rail due to gyroscopic and centrifugal couple. Refer figure no-1  Figure -1	**10**	**CO 7**

SECTION-C			
Q 10	a) Drive an expression to find outer and inner turning circle radius and steering correct angle of front and rear wheel when vehicle is taking left turn. [10] b) Illustrate the Ackerman's steering mechanism with neat diagram. [10] (Or) c) List out the methods to predict the forces and torques at different regions of steering linkages [10] d) Write the detailed design procedure of Individual components steering system including any one type of steering gears. [10]	**20**	**CO 5**
Q 11	Determine the maximum bending stress ,Maximum shear stress, Principal stress and von Mises stress and deflection of the I-cross section of ladder frame for the following data; Wheelbase=180cm, overall length=360cm, Equal overhang on either side. 270 kgf acting on C.G of the load 45cm in front of front axle. 180 kgf acting on C.G of load 45cm in front of rear axle. 67.5 kgf acting on C.G of load 45cm behind rear axle. In addition, there is a uniformly distributed load of 1.75 kgf per cm run over the entire length of chassis. For I - section of flange width and thickness are 200 mm and 25mm respectively web thickness is 12.5 mm total height of beam is 300 mm.	**20**	**CO 1**