MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (AUTOMOBILE ENGINEERING & ELECTRICAL VEHICLE TECHNOLOGY)
MAKE UP EXAMINATIONS, JUNE 2024

VEHICLE DYNAMICS [AAE 5214]
REVISED CREDIT SYSTEM

Time: 3 Hours   **Date: 19/06/2024**   **Max. Marks: 50**

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

Q.NO	Questions	Marks	CO	BTL
1A.	Sketch a standard airfoil used for vehicle spoilers, and state the influence of the angle of attack on the aerodynamic drag.	(04)	CO3	3
1B.	Illustrate the effect of yaw angle on the directional stability of the vehicle.	(03)	CO1	2
1C.	What is meant by bath-tub configuration in vehicle bodies? Whether this design is aerodynamic?	(03)	CO3	3
2A.	How do the following factors affect rolling resistance? a) Tyre Temperature b) Tyre Inflation c) Tyre Construction d) Tyre Size	(04)	CO3	3
2B.	Distinguish between attached and separated flows.	(03)	CO4	3
2C.	A car is moving at a constant velocity of 108 km/h. Determine the free stream velocity to be used in fluid flow analysis if a) the air is calm, b) wind is blowing against the direction of motion of the car at 18 km/h, and c) wind is blowing in the same direction of motion of the car at 18 km/h.	(03)	CO1	3
3A.	Experiments are conducted in a wind tunnel with a wind speed of 50 km/h on a car having area of 2 m². The density of air is 1.15 kg/m³. the coefficient of lift and drag are 0.75 and 0.15 respectively. Determine a) The lift force	(03)	CO4	4

	b) The drag force			
	c) The resultant force			
3B.	A bicyclist of mass 70 kg supplies 300 watts of power while riding into a 3 m/s head wind. The frontal area of the cyclist and bicycle together is 0.362 m^2, the drag coefficient is 0.88, and the coefficient of rolling resistance is 0.006. Consider the weight of the bicycle to be 30% of that of the cyclist. Determine the speed of the cyclist.	*(04)*	*CO3*	*3*
3C.	Explain the role of Von Karman Vortex Street in evaluation of wind noise in vehicles.	*(03)*	*CO1*	*3*
4A.	Derive the expression for tire forces for a car parked on an inclined road, using a neat sketch.	*(03)*	*CO1*	*4*
4B.	With a schematic sketch, illustrate the working of Anti-lock braking system	*(03)*	*CO1*	*3*
4C.	A Taurus GL Sedan with 3.0 L engine accelerates from a standing, up a 7 percent grade at an acceleration of 8 ft/s^2. The curb weights are 1988 lb on the front axle and 1075 lb on the rear. The wheel base is 110 inches. And the front passenger's weight is distributed 48% on the front axle and 52 % on the rear. Assume 185 lb driver, and CG height is 17 inches. Find the load distribution on the axles at this condition. (1ft/s^2 = 0.305 m/s^2, 1 lb = 0.453 kg)	*(04)*	*CO1*	*3*
5A.	How is rolling resistance developed in a tire? Elucidate with a schematic sketch.	*(04)*	*CO2*	*3*
5B.	Briefly explain the tire terminology given as follows P215/60 R 15 96H and also calculate the tire height.	*(03)*	*CO2*	*3*
5C.	With the necessary plot, describe what is brake proportioning	*(03)*	*C02*	*3*

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