Exam Date & Time: 29-Nov-2022 (02:00 PM - 05:00 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

## MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL V SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV 2022 AUTOMOTIVE CHASSIS AND SUSPENSION [AAE 3171]

## Marks: 50

**Duration: 180 mins.** 

А

## Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

Classify the types of frames used in vehicles. With suitable layout, explain their salient features.
(4)

A)

A)

- B) Explain the importance of vehicle center of gravity and with necessary block diagram. Explain any one method of determination of center of gravity of the vehicle. (3)
- C) A vehicle of total weight 49050 N is held at rest on a slope of 10°. It has a wheelbase of 2.25 m and its center of gravity is 1.0 m in front of the rear axle and 1.5 m above the ground level. Find the normal reactions at the wheels. Assuming that sliding doesn't occur first, what will be the angle of slope so that the vehicle will overturn? Assuming all the wheels are to be braked, what will be to slide if the coefficient of adhesion between the tyre and the ground is 0.35?
- 2) With necessary sketches, explain the distribution of braking and driving torque in tandem axle leaf spring suspension system.
  - B) Sketch and explain the working of hydra gas suspension system used in commercial vehicles. (4)
  - C) A motorcar weights 13341.5 N and has a wheelbase of 2.65 m. The C.G. is 1.27 m behind the front axle and 0.76 m above the ground lever. Maximum braking on all four wheels on level ground will bring the vehicle uniformly to rest from a speed of 64 km/hr in a distance of 25.9 m. Calculate the value of an adhesion between the tyre and the road. Under the same road condition, the vehicle descends a hill of gradient 1 in 20 and is braked on the front wheels only. Determine the load distribution between the front and rear wheels and the distance required to bring the car to rest.
- 3) Identify the requirements of wheel assembly of vehicle. Discuss with the help of simple sketches, the construction and features of various types of disc wheels. (4)

(3)

	A)		
	B)	With suitable block diagram, describe in detail the working of Vickers power steering system.	(3)
	C)	Explain the behaviour of vehicle tyre under the influence of braking and driving torque on a level road.	(3)
4)		With simple layout, explain the features and working of Macpherson independent suspension system.	(3)
	A)		
	B)	Derive the expression for the braking torque on leading and trailing shoe under equilibrium condition and prove that Braking torque on leading shoe is higher than the trailing shoe.	(3)
	C)	Explain in detail the construction and operation of a brake chamber and brake valve used in pneumatic brakes.	(4)
5)	A)	A high performance car has disc brakes fitted to the front wheels having two calipers per disc operating at mean radius of 16 cm. the pads are operated by opposed pistons of 3.8 cm diameter. The coefficient of friction between pads and disc is 0.42. The driver through the brake pedal and master cylinder raises the line pressure to 1430 kN/m <sup>2</sup> during moderate retardation and this pressure is increased to 3260 kN/m <sup>2</sup> by brake servo assistance. The rear brakes account for 23% of the front brakes retarding torque. Determine the total braking torque during the retardation.	(3)
	B)	A closely coiled helical spring of vehicle suspension system is made up of 10 mm diameter steel wire having 10 coils with 80 mm mean diameter. If the spring is subjected to an axial twist of 10 kN-mm, determine the bending stress and increase in the number of turns. Take E as 200 GPa.	(3)
	C)	Identify and explain any three types of failures encountered in suspension system, steering, tyres and braking system.	(4)

-----End-----

(4)