Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: AU403
Course Name: VEHICLE DYNAMICS

Max. Marks: 100   Duration: 3 Hours

PART A
Answer any two full questions, each carries 15 marks.   Marks

1 a) Define DOF. Also, explain damped vibration.   (5)

   b) Explain how the tire dynamics affects the performance of the vehicle during   (10)
       cornering.

2 a) A Leyland truck has a gross vehicle weight of 89026 N. Engine displacement is   (10)
       $10m^3$, power 77.3 kW at governed speed of 2400 rpm and maximum torque
       345.8 Nm at 1400 rpm. Rear axle ratio is 6.166: 1. Fourth speed reduction ratio
       in transmission is 1.605: 1, drive line losses amount to 10.7 kW at 2400 rpm and
       6.3 kW at 1400 rpm. Tyre size is 0.4572 *m* x1.016 *m* (effective wheel diameter
       0.950 m), frontal area of truck is 6.95 m^2. Calculate the grade which vehicle can
       climb in fourth gear in still air conditions: a) at governed engine speed b) at
       speed of maximum torque in the equation $R = KW + K_a AV^2$, Where K = 0.044,
       K_a = 0.0462 and V in kmph.

   b) What are the factors influencing cornering stiffness?   (5)

3 a) Discuss in detail the road performance cures for acceleration, gradability and   (8)
       drawbar pull.

   b) Explain i) Power consumed by tires ii) Tire vibrations iii) Tire stiffness   (7)

PART B
Answer any two full questions, each carries 15 marks.

4 a) A car weighing 21336.75 N has a static weight distribution on the axles of 50:50.   (10)
       The wheel base is 3 m and the height of centre of gravity above ground is 0.55
       m. If the co efficient of friction on the highway is 0.6, calculate the advantage of
       having rear wheel drive rather than front wheel drive as far as gradability is
       concerned, if the engine power is not a limitation.

   b) Describe the theory of chasis spring.   (5)

5 a) Describe in detail about the requirements of a good suspension system.   (7)

b) Obtain the expressions for maximum acceleration, tractive efforts and reactions for a four wheeled vehicle when the drive is given to i) Front wheels ii) rear wheels (8)

6 a) Obtain the expression for the final forces acting on the limbs of an independent suspension under the action of vehicle force and horizontal force. (10)

b) Define roll axis. (5)

PART C
Answer any two full questions, each carries 20 marks.

7 a) Discuss in detail about the mechanics of air flow over a vehicle. (10)

b) Derive the equation for braking efficiency and stopping distance. (5)

c) Explain brake fade. (5)

8 a) Derive the expressions for forces acting on a four wheeler moving on a level road when brakes are applied to i) rear wheels ii) front wheels (10)

b) What is rolling resistance? Describe in detail about the factors that affect the rolling resistance. (10)

9 a) The resistance to the motion of a motor car when running on the level with the engine free is given by $R = a+bV^2$, where a and b are constants and V is in Km/h. A vehicle weighing 15402 N with a free engine while running down a slope of 1 in 30 reaches a speed of 56 km/h, while running down a slope of 1 in 20 reaches a speed of 80 km/h. The engine is declutched after the car is run upto 96 km/h on level. Assuming that the mean resistance during running down is 45% that of 96 km/h, Calculate the distance run by the vehicle before it comes to rest (a) If the brakes are not applied (b) If in addition to resistance above a constant braking force of 2403.5 N is applied (10)

b) Explain different aerodynamic aids which are used to reduce drag. (10)

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