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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, M. Tech. - Mechanical Engineering (MMDN)

Semester End Examination; Dec - 2016/Jan - 2017

Vehicle Dynamics

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Missing data, if any, may be suitably assumed.

UNIT - I

1 a. Explain the phenomena of hydroplanning of pneumatic tyres. 8

b. What are the forces acting on the vehicle in static and dynamic conditions? 8

c. How lugs-voids configurations affects the tire traction and noise level? 4

2 a. Explain the effects of improper inflation pressure in tyres on the dynamics of the vehicle. 6

b. Derive expression for axle loads for an ideal accelerating four wheel drive car on level road. 6

c. A motor car with wheelbase of 2272 mm with the centre of mass 1285 mm above the ground and 1136 mm in front of rear axle has coefficient of adhesion 0.9 between the tyres and ground. Calculate the minimum time required for the car to accelerate from 0 to 100 km/hr on level road if the car is, 8

i) Rear wheel drive ii) Front wheel drive iii) All wheel drive.

UNIT - II

3 a. Explain the significance of height of the mass center of the vehicle on its dynamic behavior. 10

b. Determine the height of the mass centre for the car with the following specifications:
Weight of the car = 8900 N
Wheel base = 2450 mm, Distance between C.G. and Rear axle = 1350 mm, Radius of front tyre = 275 mm, Radius of rear tyre = 300 mm. The force measured at the front wheels when the rear wheel is raised at an angle of 11.6º is 5800 N. 10

4 a. Obtain expression for maximum acceleration for car on an inclined road. 10

b. An all wheel drive car with mass = 2058.9 kg, wheel base = 2750.8 mm, C.G. is at 760 mm above ground and at centre of wheel base. Find the axle loads if the car is accelerating at 1.7 m/s^2. 10

UNIT - III

5 a. What is brake proportioning? List the basic requirements of good braking system. 10

b. A van Fig. with wheel base of 2,900 mm, with the centre of mass 700 mm above the ground and 1800 mm in front of rear axle has weight of 1555 kg. Determine the breaking efficiency of the vehicle for which braking is forces at the front and rear axles. 10

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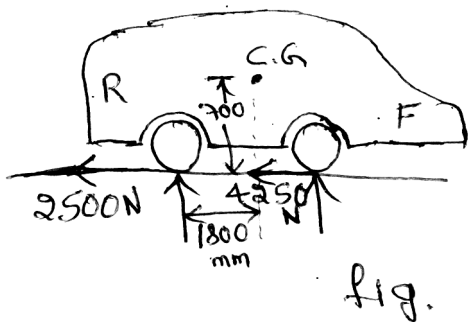

fig.

6 a. Write conditions for wheel lockup and how ABS prevents wheel lockup. 10

b. For a light truck weighing 16168.48 N performing a full stop from 96.54 km/h on a level road, with the brake application that develops a steady state brake force of 8896 N. Determine the deceleration, stopping distance, time to stop, energy dissipated and brake power at initial application and averaged over the stop. Neglect aerodynamic and rolling resistance forces. 10

UNIT - IV

7 a. With the help of diagram explain how camber affects vehicle suspensions and tyre wear. 10

b. How the understeer can be measured at constant speed by varying the steer angle? 10

8 a. Obtain the expression of condition for true rolling of vehicle on road. 10

b. Obtain analytical solution for Ackerman steering mechanism. 10

UNIT - V

9 a. Explain the different aerodynamic forces acting on a car with neat diagram and equations. 10

b. Explain various sources of vibration in automobile and steps undertaken to evaluate vehicle vibration. 10

10. Write short notes on the following:

a) Bumper spoilers 5

b) Air dams 5

c) Deck-lid spoilers 5

d) Aerodynamic lift and drag. 5

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