Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE – SEMESTER- VII EXAMINATION-SUMMER 2023**

**Subject Code: 3170203 Date: 21/06/2023**

**Subject Name: Vehicle Dynamics**

**Time: 10:30 AM TO 01:00 PM Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | **Marks** |
|---|---|---|---|
| **Q.1** | **(a)** | Define : (i) Rolling moment (ii) Heading angle (iii) Pitching moment | **03** |
| | **(b)** | Explain the importance of lumped mass analysis in vehicle dynamics in brief | **04** |
| | **(c)** | Derive the expression for the axle load when vehicle is parked on level ground. | **07** |
| **Q.2** | **(a)** | Explain the working of anti roll bar in short. | **03** |
| | **(b)** | Compare the performance characteristics of gasoline and diesel engine in short. | **04** |
| | **(c)** | Derive the expression for tractive force for power limited acceleration and show that part of the tractive force is lost to overcome the inertia of various system. | **07** |
| | | **OR** | |
| | **(c)** | Derive the expression for tractive force for traction limited acceleration with necessary assumption. | **07** |
| **Q.3** | **(a)** | Differentiate between vehicle drag and vehicle lift. | **03** |
| | **(b)** | Explain the boundary layer thickness in vehicle aerodynamics. | **04** |
| | **(c)** | Explain the effect of tire road friction on braking performance of vehicle. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain under steer, over steer and neutral steer condition. | **03** |
| | **(b)** | Explain the importance of the brake factor. | **04** |
| | **(c)** | Explain the pressure distribution over the vehicle body in detail with neat sketch. | **07** |
| **Q.4** | **(a)** | Define : (i) Roll center (ii) wake (iii) air dam | **03** |
| | **(b)** | Enlist vehicle aerodynamic aids and explain any one in detail. | **04** |
| | **(c)** | Explain the terminology used in tire axis system with neat sketch. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Classify the vehicle suspension system. | **03** |
| | **(b)** | Explain the Roll center analysis for independent suspension system in short. | **04** |
| | **(c)** | Explain the ant-dive suspension geometry in detail with neat sketch | **07** |
| **Q.5** | **(a)** | Define : (i) Camber angle (ii) Caster angle and (iii) Toe-out | **03** |
| | **(b)** | Explain the mechanism for force generation in tire. | **04** |
| | **(c)** | Discuss the effect of slip angle and inflation pressure on the performance of the tire. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Give the three reason why 100 % anti dive geometry is not preferred? | **03** |
| | **(b)** | Explain the resistance forces acting on motorcycle during motion. | **04** |
| | **(c)** | Discuss the quasi-static roll over of rigid vehicle. | **07** |

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