Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3170203 Date:19-11-2024

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.**

Q.1	**(a)**	Explain Anti-lock Brake system.	**03**
	(b)	Explain importance of SAE Axis system and vehicle Earth Coordinate system for understanding universal convention of vehicle's dynamic forces.	**04**
	(c)	Derive an equation to calculate the dynamic axial load for the following condition (i) Vehicle is on ground and (ii) vehicle is on grade.	**07**
Q.2	**(a)**	Explain Vehicle Fixed Co-ordinate system	**03**
	(b)	Write a short note on aerodynamic drag	**04**
	(c)	Explain the traction limited acceleration and derive the expression for tractive force required to accelerate the vehicle.	**07**
		OR	
	(c)	Draw a sketch of arbitrary forces acting on a vehicle and derive the dynamic forces W_f & W_r acting on front & rear tyres, considering vehicle moving on up gradient, with hitch load and acceleration a_x.	**07**
Q.3	**(a)**	Explain Vehicle drag components.	**03**
	(b)	Explain the meaning of the following tyre size code and calculate the tyre height for given tyre. P 215 / 60 R 15 96 H.	**04**
	(c)	Define Neutral steer, Over steer and Under steer conditions in a vehicle and discuss the dependent parameters.	**07**
		OR	
Q.3	**(a)**	Draw clear sketch of Tyre axis system and explain the details.	**03**
	(b)	Derive Ackerman steering condition. Which assumptions are considered while applying this condition?	**04**
	(c)	Explain Tyre cornering forces with equations.	**07**
Q.4	**(a)**	Define: (i) Pitching moment, (ii) Camber angle, (iii) Drag force	**03**
	(b)	Differentiate drum brake and disk brake based on construction and dynamics point of view.	**04**
	(c)	Explain the following turning response properties: Under steer gradient, Neutral steer, Under steer, Over steer, Characteristic speed and Critical speed	**07**
		OR	
Q.4	**(a)**	What is the important of rollover? List types of rollover of the vehicle.	**03**
	(b)	Explain MacPherson Strut Suspension system with neat sketch.	**04**
	(c)	Compare active suspension and passive suspension system based on different performance mode.	**07**

Q.5	**(a)**	Explain Lumped mass, Sprung and Un-sprung mass.	**03**
	(b)	Explain the mechanism of tyre – road friction.	**04**
	(c)	Explain with neat sketch Kinematic structure of motorcycle	**07**

OR

Q.5	**(a)**	Differentiate between Davis steering and Ackerman steering mechanism.	**03**
	(b)	Describe about aerodynamic aids.	**04**
	(c)	Discuss the quasi static rollover of suspended vehicle in detail	**07**

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