Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2019

AU3CO15 Vehicle Dynamics

Programme: B.Tech. Branch/Specialisation: AU

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Larger wheels are provided at the rear of a tractor to ensure: **1**

(a) High Speed (b) High Torque

(c) Both (a) and (b) (d) None of these

ii. Newton's equations of motions are applicable to: **1**

(a) Uniform motion only (b) Non-Uniform motion only

(c) Both (a) and (b) (d) None of these

iii. Contact area between tire & road surface is called: **1**

(a) Contact area (b) Patch area

(c) Slip area (d) Friction area

iv. Slip angle is related to: **1**

(a) Front wheels (b) Rear wheels

(c) Both (a) and (b) (d) None of these

v. Axles are part of: **1**

(a) Sprung mass

(b) Unsprung mass

(c) May be Sprung/May be Unsprung

(d) None of these

vi. Steering geometry mechanisms can be: **1**

(a) Ackermann Mechanism (b) Davis Mechanism

(c) Both (a) and (b) (d) None of these

vii. A vehicle rollover due to: **1**

(a) Unstability (b) Inequilibrium

(c) Both (a) and (b) (d) None of these

P.T.O.

viii. Quasi-Static state of a vehicle is related to: **1**
(a) Stability (b) Equilibrium
(c) Both (a) and (b) (d) None of these

ix. A moving two-wheeler balances itself by balancing its: **1**
(a) Weight (b) Moment of Inertia
(c) Angular Momentum (d) None of these

x. Rear wheel width of a motorcycle is: **1**
(a) Always more than that of front wheel
(b) May be less than that of front wheel
(c) Always equal to that of front wheel
(d) May be equal to or more than that of front wheel

Q.2 i. Classify Vehicle Dynamics. **2**

ii. Write any three differences between Longitudinal & Lateral Dynamics. **3**

iii. Derive the expression to calculate Braking Distance of a double axled vehicle. **5**

OR iv. Draw a neat sketch to show Vehicle Load Distribution on a double axled vehicle. **5**

Q.3 i. Enlist any four Mechanical Properties of Rubber. **2**

ii. Compare the construction of a Cross ply and a Radial ply tire diagrammatically. Which one is better and why? **8**

OR iii. Explain how Tire Construction affects Force Development pattern between tire & road surface? Use equations & diagrams, wherever necessary. **8**

Q.4 i. What is Wheel Hop? Is it preferable? **3**

ii. What do you mean by Suspension Geometry? What is its utility? Explain Ackerman Steering Geometry with a neat labelled sketch. **7**

OR iii. What is an Independent Suspension system? What are its benefits over conventional suspension system? Draw a neat sketch of Double Wishbone Suspension system with proper labelling. **7**

Q.5 i. What is the importance of Quasi-Static stage in the study of Rigid Vehicle? **4**

ii. Explain the phenomenon of Quasi-Static Rollover of a Suspended Vehicle in details. **6**

OR iii. Explain the phenomenon of Transient Rollover of a Rigid Vehicle in details. **6**

Q.6 Attempt any two:

i. Explain the various Resistance forces that act on a moving motorcycle. **5**

ii. Explain the effect of Moments of inertia on a moving Motorcycle. **5**

iii. Explain how Location & height of a motor cycle's centre of gravity (C.G) effect its dynamic behaviour. **5**

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Marking Scheme
AU3CO15 Vehicle Dynamics

Q.1	i.	Larger wheels are provided at the rear of a tractor to ensure: (b) High Torque	**1**
	ii.	Newton's equations of motions are applicable to: (c) Both (a) and (b)	**1**
	iii.	Contact area between tire & road surface is called: (b) Patch area	**1**
	iv.	Slip angle is related to: (c) Both (a) and (b)	**1**
	v.	Axles are part of: (c) May be Sprung/May be Unsprung	**1**
	vi.	Steering geometry mechanisms can be: (c) Both (a) and (b)	**1**
	vii.	A vehicle rollover due to: (a) Unstability	**1**
	viii.	Quasi-Static state of a vehicle is related to: (a) Stability	**1**
	ix.	A moving two-wheeler balances itself by balancing its: (c) Angular Momentum	**1**
	x.	Rear wheel width of a motorcycle is: (d) May be equal to or more than that of front wheel	**1**
Q.2	i.	Classification Vehicle Dynamics.	**2**
	ii.	Any three differences between Longitudinal & Lateral Dynamics. 1 mark for each (1 mark * 3)	**3**
	iii.	Derivation to calculate Braking Distance of a double axled vehicle. Full marks for full derivation, else proportionate	**5**
OR	iv.	Draw Vehicle Load Distribution on a double axled vehicle. Full marks for Complete sketch, else proportionate	**5**
Q.3	i.	Any four Mechanical Properties of Rubber.	**2**
	ii.	Diagram of construction of a Cross ply 3 marks Diagram of construction of a Radial ply 3 marks Theory explanation 2 marks	**8**
OR	iii.	Tire Construction affects Force Development pattern between tire & road surface 5 marks	**8**
		Use equations & diagrams 3 marks	
Q.4	i.	Wheel Hop 2 marks Is it preferable 1 mark	**3**
	ii.	Suspension Geometry 2 marks Its utility 1 mark Ackerman Steering Geometry with sketch 4 marks	**7**
OR	iii.	Independent Suspension system 2 marks Benefits over conventional suspension system 2 marks Sketch of Double Wishbone Suspension system 3 marks	**7**
Q.5	i.	Importance of Quasi-Static stage in the study of Rigid Vehicle	**4**
	ii.	Phenomenon of Quasi-Static Rollover of a Suspended Vehicle	**6**
OR	iii.	Phenomenon of Transient Rollover of a Rigid Vehicle	**6**
Q.6		Attempt any two:	
	i.	Resistance forces that act on a moving motorcycle.	**5**
	ii.	Effect of Moments of inertia on a moving Motorcycle.	**5**
	iii.	Location & height of a motor cycle's centre of gravity (C.G) effect its dynamic behaviour. Derivation 3 marks Diagram 2 marks	**5**

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