Enrollment No.....................................

Faculty of Engineering
End Sem (Even) Examination May-2022
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.	Traction force is required for:	**1**

         (a) Stability of vehicle   (b) Propel the vehicle
         (c) Control the vehicle   (d) None of these

     ii.   Coefficient of friction is: **1**
         (a) Friction force acting when body is just about to move
         (b) Friction force acting when body is in motion
         (c) Ratio of limiting friction to normal friction
         (d) None of these

     iii.   The ratio of tyre section height to the tyre section width is known as: **1**
         (a) Aspect ratio   (b) Tyre ratio
         (c) Ply Ratio   (d) None of these

     iv.   The radius of a pneumatic tyre is: **1**
         (a) The radius of unloaded fully inflated tyre
         (b) The height of centre of tyre from the ground when it is loaded
         (c) It is fixed radius, based on the dimensions of the tyre
         (d) None of these

     v.   The basic function of the suspension is to: **1**
         (a) Automatically correct the effects of over steering
         (b) Ensure that the steering wheel can deliver a suitable amount of steering force
         (c) Ensure that wheel alignment is not disturbed during driving
         (d) Absorbs vibration and impact from road surface

vi.   A front stabilizer bar is used to: **1**
(a) Increase vehicle load carrying capacity
(b) Provide a softer ride
(c) Control suspension movement and body roll
(d) All of these

vii.   Roll center is the pivot around which: **1**
(a) Vehicle roll occurs   (b) Body roll occurs
(c) Instantaneous center   (d) All of these

viii. What causes rollover accident?   **1**
(a) Loss of vehicle control   (b) Risky maneuvers
(c) Both (a) and (b)   (d) None of these

ix.   Which of the following quantity represent the gear ratio "G" for a   **1**
two-wheeler vehicle? (w= wheels, e= engine, R= radius of track, $r_{w=}$
radius of wheels & I= moment of inertia)
(a) ω_w / ω_e (b) ω_e / ω_w (c) r_w / R (d) I_e / I_w

x.   What is the relation between overturning couple and balancing   **1**
couple for the stability of vehicle?
(a) Independent of each other
(b) Overturning couple is greater
(c) Balancing couple is greater
(d) Equal to each other

Q.2   i.   Define Vehicle Dynamics by SAE.   **2**
ii.   Explain longitudinal and lateral dynamics.   **3**
iii.   Derive an expression for load distribution during braking when   **5**
vehicle is on inclined path.
OR   iv.   What is meant by braking distance? Derive an expression for   **5**
minimum braking distance.

Q.3   i.   Define slip and grip.   **2**
ii.   Explain radial ply and cross ply tyre construction. Write any four   **8**
advantages of radial ply construction.
OR   iii.   Explain contact patch and contact pressure distribution with   **8**
sketches.

Q.4   i.   What is wheel hop? Write any two causes of wheel hop.   **3**
ii.   What is Anti Dive suspension? Explain geometry of Anti Dive   **7**
suspension with sketch.
OR   iii.   What is an independent suspension? Explain McPherson strut   **7**
suspension system with sketch.

Q.5   i.   What is the importance of Quasi-Static stage in the study of   **4**
suspended vehicle?
ii.   Explain Quasi-Static rollover of Rigid vehicle in detail with sketch.   **6**
OR   iii.   Explain Transient Rollover of a Rigid Vehicle in detail with sketch. **6**

Q.6   Attempt any two:
i.   Explain kinematic structure of motorcycle with sketch.   **5**
ii.   Explain various resistance forces acting on moving motorcycle.   **5**
iii.   Explain the effect of Location & height of a motorcycle's centre of   **5**
gravity (C.G) on dynamic behaviour of motorcycle.

*****

Marking Scheme
AU3CO15 Vehicle Dynamics

Q.1 i. Traction force is required for: **1**
(b) Propel the vehicle

ii. Coefficient of friction is: **1**
(c) Ratio of limiting friction to normal friction

iii. The ratio of tyre section height to the tyre section width is known as: **1**
(a) Aspect ratio

iv. The radius of a pneumatic tyre is: **1**
(a) The radius of unloaded fully inflated tyre

v. The basic function of the suspension is to: **1**
(d) Absorbs vibration and impact from road surface

vi. A front stabilizer bar is used to: **1**
(c) Control suspension movement and body roll

vii. Roll center is the pivot around which: **1**
(a) Vehicle roll occurs

viii. What causes rollover accident? **1**
(c) Both (a) and (b)

ix. Which of the following quantity represent the gear ratio "G" for a two-wheeler vehicle? (w= wheels, e= engine, R= radius of track, r_w= radius of wheels & I= moment of inertia) **1**
(b) ω_e / ω_w

x. What is the relation between overturning couple and balancing couple for the stability of vehicle? **1**
(d) Equal to each other

Q.2 i. Definition of Vehicle Dynamics by SAE. **2**

ii. Longitudinal   1.5 marks   **3**
Lateral dynamics   1.5 marks

iii. Derivation of an expression with diagram **5**

OR iv. Braking distance   1 mark   **5**
Derivation of expression   4 marks

Q.3 i. Definition of slip   1 mark   **2**
Grip   1 mark

ii. Radial ply tyre   3 marks   **8**
Cross ply tyre construction   3 marks
Any four advantages of radial ply construction
0.5 mark for each (0.5 mark * 4)   2 marks

OR iii. Contact patch   4 marks   **8**
Contact pressure distribution with sketches   4 marks

Q.4 i. Wheel hop   2 marks   **3**
Any two causes of wheel hop
0.5 mark for each (0.5 mark * 2)   1 mark

ii. Anti Dive suspension   2 marks   **7**
Geometry of Anti Dive suspension   3 marks
Sketch   2 marks

OR iii. Independent suspension   2 marks   **7**
McPherson strut suspension system   3 marks
Sketch   2 marks

Q.5 i. Importance of Quasi-Static stage   **4**
As per the explanation

ii. Quasi-Static rollover of Rigid vehicle   4 marks   **6**
Sketch   2 marks

OR iii. Transient Rollover of a Rigid Vehicle   4 marks   **6**
Sketch   2 marks

Q.6   Attempt any two:

i. Kinematic structure of motorcycle   3 marks   **5**
Sketch   2 marks

ii. Resistance forces acting on moving motorcycle   **5**
As per the explanation

iii. Effect of Location   2.5 marks   **5**
Effect of height of a motorcycle's centre of gravity (C.G)   2.5 marks

*****