



B.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Sixth Semester

AUTOMOBILE ENGINEERING

U18AUI6202: Vehicle Dynamics

COURSE OUTCOMES

- CO1:** Identify the forces acting on vehicle for the given conditions and draw free body diagram.
CO2: Infer and explain the phenomena of the forces that acts on the vehicle.
CO3: Determine the reaction forces induced in the vehicle.
CO4: Develop mathematical model of the vehicle system and elements
CO5: Provide solution by developing model and solving it
CO6: Justify the vehicle response for the forces and moments that acts on the vehicle.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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| 1. Sketch SAE Tire axis diagram | CO1 [K ₁] |
| 2. Explain Hydroplaning in tires | CO2 [K ₂] |
| 3. Differentiate Damped system and Undamped system | CO4 [K ₂] |
| 4. Define Degrees of freedom | CO4 [K ₁] |
| 5. Explain the need for Banking of road. | CO6 [K ₂] |
| 6. Suggest an ideal braking force distribution ratio for four-wheel passenger vehicle and justify. | CO2 [K ₂] |
| 7. Draw a Free body diagram of any system with single degree of freedom and derive its equation of motion. | CO4 [K ₃] |
| 8. Calculate the longitudinal position of c.g for vehicle having 1200 cm wheel base. The entire weight of the vehicle is 1800 kg with weight distribution of 60:40 ratio at front and rear axle. | CO3 [K ₃] |
| 9. List out the properties of Sound | CO2 [K ₂] |
| 10. Mention few sources of vibration in a vehicle | CO1 [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 4 = 20 Marks)

(Answer not more than 80 words)

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| 11. Sketch SAE Vehicle Axis Diagram and Explain the Moments occurring in the vehicle with respect to SAE Axis. | CO1 [K ₂] |
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| 12. | Draw a free body diagram of a vehicle accelerating downward on slope and list out the forces acting on it | CO1 | [K ₂] |
| 13. | With neat sketch explain the rolling resistance developed in a tire with respect to pressure distribution at the contact patch | CO2 | [K ₂] |
| 14. | Derive Equation of motion for a simple quarter car model with required free body diagram | CO4 | [K ₃] |
| 15. | Consider a vehicle is moving downwards on a slope and a sudden brake is applied, explain the influence of load shift on the stability of the vehicle. Suggest the Height of C.G such that vehicle load shift is minimum | CO5 | [K ₃] |
| 16. | Vehicle moving on a straight Road is braked and the front left wheel of the vehicle is locked. Illustrate the vehicle motion with respect to the forces developed for mentioned conditions. | CO6 | [K ₃] |

**Answer any FIVE Questions:-
PART C (5 x 12 = 60 Marks)
(Answer not more than 300 words)**

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| 17. | Derive Reaction forces for a vehicle accelerating on a slope and deduce the expression of Maximum tractive effort that a Front wheel drive vehicle could generate. | CO3 | [K ₃] |
| 18. | With neat sketch Explain the influence of Inflation pressure, Running time, type of road Surface | CO2 | [K ₂] |
| 19. | Demonstrate the working of Passive, Semi-active and Active suspension system | CO4 | [K ₂] |
| 20. | Consider a Vehicle accelerating around a corner and taking right turn on a banked surface. Now derive the equation to describe the stability of the vehicle and state the condition for vehicle to be rolled over. | CO5 | [K ₃] |
| 21. | Illustrate the stability of the vehicle with respect to under steer, neutral steer and over steer | CO6 | [K ₂] |
| 22. | Explain the testing procedure involved in tail pipe noise measurement of a stationery vehicle. | CO2 | [K ₂] |
