



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(AUE)/SEP. SUPPLE/SEM-7/AUE-701/2012
2012

VEHICLE DYNAMICS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

$$10 \times 1 = 10$$

- i) Power consumed by the near wheel of rear wheel driven vehicle is
- a) greater than that of front wheels
 - b) less than that of front wheels
 - c) equal to that of front wheels
 - d) can't be compared.
- ii) Damping ratio is equal to
- a) $mc / 2\omega_n$
 - b) $m / 2c\omega_n$
 - c) $\omega_n / 2mc$
 - d) $c / 2m\omega_n$



- iii) When a vehicle is suddenly accelerated, then
- front wheels will be rebound
 - rear wheel will be rebound
 - front wheels will be jounced
 - rear wheel will be jounced.
- iv) Braking torque on the trailing shoe is
- greater than that of leading shoe
 - less than that of leading shoe
 - equal to that of leading shoe
 - none of these.
- v) Which of the following is not a spring control governor ?
- Hartnell
 - Porter
 - Pickering
 - Hartung.
- vi) Type rigidity of vehicle varies from
- 10-15 kN/m
 - 200-450 kN/m
 - 20-60 kN/m
 - none of these.
- vii) Human body does not feel the vibration effect when frequency of vibration lies between
- 40 to 50 Hz
 - 18 to 28 Hz
 - 10 to 20 Hz
 - 1.17 to 1.60 Hz.
- viii) When a vehicle is taking turn and brakes are applied ? The vehicle will be under
- Apt load condition
 - force load condition
 - neither Apt nor force load condition
 - Apt and force load conditions.
- ix. A vehicle is travelling on level ground and taking a turn, skidding speed of the vehicle depends on
- vehicle parameters only
 - road parameters only
 - both (a) and (b)
 - none of these.
- x) Acceleration of the front wheel driven vehicle is given by
- $f = \mu g$
 - $f = g\mu l g + \mu h$
 - $f = (b - 1) \mu b - \mu h$
 - $f = b + \mu h g \mu l$.



GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

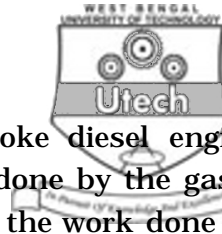
2. Derive the relation $\Delta E = 2EC_s$ where ΔE = maximum fluctuation of energy, E = mean kinetic energy, C_s = coefficient of fluctuation of speed.
3. Obtain the expression of rear suspension load, when the vehicle brakes suddenly.
4. Define the following terms relating to governors :
 - a) Governors effort
 - b) Governors power
 - c) Isochronous.
5. Prove the transverse vibration frequency of cantilever beam is dependent only of its deflection.
6. Deduce the expression of wheel reaction, when the vehicle is under the static load condition.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. In an I.C. engine governor of the Porter type, the upper and lower arms are 200 mm and 225 mm respectively and pivoted on the axis of rotation. The mass of the central load is 12 kg the mass of each ball is 2 kg and friction of sleeve together with the resistance of the operating gear is equal to the load of 24 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40° , find taking friction into account, range of speed of governor.



8. A single cylinder, single acting, four stroke diesel engine develops 20 kW at 300 r.p.m. The work done by the gases during the expansion stroke is three times the work done on the gases during the compression stroke, the work done during the suction and exhaust stroke being negligible. If the total fluctuation of speed is not to exceed $\pm 1.5\%$ of the mean speed and turning moment diagram during compression and expansion is assumed to be triangular in shape, find the moment of inertia of the flywheel.
9. a) Obtain the expression of lateral force on a vehicle both for front and rear wheels in terms of different vehicle and road parameters. 10
 b) A vehicle of 800 kg has wheel base 2.5 m C.G. of the vehicle is 1.2 m from the rear axle and 0.75 m above ground level. Track length 1.5 m. What should be the Ackerman angle of the vehicle, if it is taking a blind turn ? 5
10. A car having wheel base 3 m and weight of 250 kg. The C.G. of the car is 1.4 m from the rear axle and 1.3 m above ground level. Plot the graph showing variation of corner stiffness against radius of curvature of the road for a maximum speed of 80 kmph. Assume radius of curvature 100, 150, 200, 250, 300 and 350 respectively.
11. a) Explain under damping by the basic equation, calculate the damped natural frequency of a under damped system. 5
 b) Determine the resultant motion of three harmonic motion given below : 10

$$x_1 = a \sin \omega t$$

$$x_2 = a \sin (\omega t + 2\pi/3)$$

$$x_3 = a \sin (\omega t + 4\pi/3).$$