



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (AUE)/SEM-7/AUE-701/2012-13

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) The coefficient of fluctuation of speed is the of maximum fluctuation of speed and the mean speed.
 - a) product
 - b) ratio
 - c) sum
 - d) difference.
 - ii) Which of the following is a spring control governor ?
 - a) Hartnell
 - b) Hartung
 - c) Pickering
 - d) All of these.
 - iii) The maximum fluctuation of energy in a flywheel is equal to
 - a) $I\omega^2Cs$
 - b) $I\omega(\omega_1 - \omega_2)$
 - c) $2I\omega^2Cs$
 - d) all of these.



- iv) The balancing of rotating and reciprocating parts of an engine is necessary when it runs at
- a) slow speed b) medium speed
c) high speed d) any one of these.
- v) Human body does not feel the vibration effect when frequency of vibration lies between
- a) 40 Hz to 50 Hz b) 18 Hz to 20 Hz
c) 10 Hz to 20 Hz d) none of these.
- vi) Reaction of front wheels : rear wheels becomes
- a) $1 - \frac{1}{b}$ b) $\frac{1}{b-1}$
c) $\frac{1}{b}$ d) none of these.
- vii) A vehicle is placed on longitudinally inclined road having the following specification : Inclination $\theta = 25^\circ$, coefficient of angle $\mu = 0.3$. The vehicle will
- a) slide down the gradient
b) be at rest
c) be overturn
d) cannot be predicted.
- viii) Same fluid pressure in drum brake system produces the braking force
- a) more than disc brake system
b) same as that disc brake system
c) less than disc brake system
d) cannot be compared.
- ix) For better tyre life the velocity of the vehicle should be
- a) 20 - 30 kmph b) 40 - 50 kmph
c) 60 - 80 kmph d) 90 - 120 kmph.



- x) Wheels will be in locking condition when
- wheel braking torque is less than brake braking torque
 - wheel braking torque is more than brake braking torque
 - wheel braking torque is equal to brake braking torque
 - wheel will be under (a) and (b) only.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following 3 × 5 = 15

- What is the function of a governor ? How does it differ from that of a flywheel ?
- Show the force resolution of the porter governor and derive the relation $N^2 = \frac{m + \frac{M}{2} (1 + q)}{m} \times \frac{895}{h}$.
- Obtain the expression of braking torque for a disc brake system operated in automobile.
- Skidding velocity and overturning velocity of a vehicle becomes same. What would be the conditions you like to suggest ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

- A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, governor effort and power of the governor by considering
 - Friction at the sleeve
 - Friction at the sleeve is neglected.



7. a) Prove $\Delta E = 2EC_s$, When E = mean kinetic energy of a flywheel, C_s = coefficient of fluctuation speed, and ΔE = the maximum fluctuation of energy.
- b) A single cylinder, single acting, four stroke diesel engine develops 20 kW at 450 rpm. 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 suction and exhaust strokes being negligible. If the total fluctuation of speed is not to exceed 3% 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. 5 + 10
8. A shaft carries four masses A , B , C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45° , B to C 70° and C to D 120° . The balancing masses are to be placed in planes X and Y . The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.
9. A motor car weighing 1000 kg having wheel base 2.15 m C.G. of the vehicle is 0.8 m from ground level and 1.0 m from rear axle. Track length is 1.22 m. Calculate the dynamic reaction on the front wheels only, when the vehicle is front wheel driven. Obtain the expression(s) with free body diagram of the vehicle those you will use.

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