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B.E SEMESTER VII Theory EXAMINATION (November / 2016)

SUBJECT CODE: AE-705 SUBJECT NAME: VEHICLE DYNAMICS

DATE: 18/11/2016 TIME: 10.30 a.m. to 01.30 p.m. TOTAL MARKS: 70

Instructions:

1. Answer each section in separate Answer Sheet.
2. Use of scientific Calculator is permitted.
3. All questions are compulsory.
4. Indicate **clearly**, the options you attempted along with its respective question number.
5. Use the last page of main supplementary for rough work.

Section - 1

Q:1 Answer the following Question. (All Compulsory)

(A) Describe vehicle stability on a slope with equation. 05

(B) Calculate maximum acceleration and reaction for two wheel drive. 05

(C) A vehicle total weight of 5000 kg is held at rest on a slope 100. It has wheel base of 2250 mm and its centre of gravity is 1000 mm in front of the rear and, 1500 mm above the ground level. Find 1.What are normal reaction at all wheels? 2. What will be overturn angle? What will be angle of slope so that the vehicle will begin to slide if the coefficient of tyre and ground is 0.35. 05

OR

(C) A motor car with wheel base 2750 mm with a centre of gravity 85 mm above ground and 1150 mm behind the front axle has a coefficient of 0.6 between tire and ground. Calculate the maximum possible acceleration when the vehicle is 05

1. Driven on four wheels 2. Driven on front wheel only and rear wheel only

Q:2 Answer the following Question.

(A) Define and explain the following terms relating to governors : 05

1. Stability, 2. Sensitiveness, 3. Isochronism, and 4. Hunting.

(B) Explain the terms 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels. 05

OR

(AB) The turning moments diagram for petrol engine is drawn to the following scales. 10

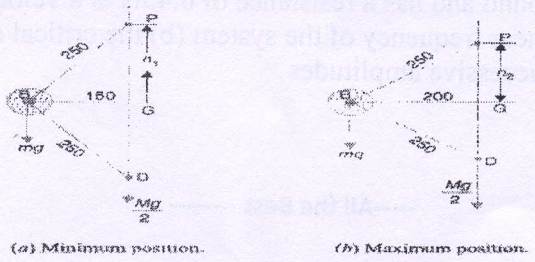
Turning moment, 1 mm = 5 N-m, crank angle , 1 mm = 1o . the turning moment diagram repeats itself at every half revolution of engine and areas above and below the mean turning line, take in order are 295, 685, 40, 340, 960, 270 mm2 .

Determine the mass of 300 mm diameter flywheel rim when the coefficient of fluctuation of speed is 0.3% and the engine runs are 1800 rpm. Also determine the cross-sectional of the rim when the width of the rim is twice of thickness. Assume density of rim material as 7250 kg/m3

Q:3 Answer the following Question.

(A) Prove that the maximum fluctuation of energy, E = E × 2CS 05

(B) 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 minimum and maximum speeds and range of speed of the governor. 05



(a) Minimum position. (b) Maximum position.

OR

(A) A Hartnell governor having a central sleeve spring and two right-angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine : 1. loads on the spring at the lowest and the highest equilibrium speeds, and 2. stiffness of the spring. 05

(B) In a spring loaded Hartnell type governor, the extreme radii of rotation of the balls are 80 mm and 120 mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 and 420 r.p.m., find: 1. the initial compression of the central spring, and 2. the spring constant. 05

Section – 2

Q:4 Answer the following Question. (All Compulsory)

(A) Write down definition of Pitching, bouncing, yawing & rolling. 05

(B) Describe the terms: Lateral Acceleration, Curvature response. 05

(C) Describe wheel wobbling and Steering geometry of vehicle. 05

OR

(C) Write any two vehicle test for handling performance. 05

Q:5 Answer the following Question.

(A) Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn. 05

(B) The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.60 m. Its speed is 2000 r.p.m. The ship pitches 6° above and 6° below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic. Determine: 1. Maximum gyroscopic couple, 2. Maximum angular acceleration of the ship during pitching. 05

OR

(AB) A rear engine automobile is travelling along a track of 100 metres mean radius. Each of the four road wheels has a moment of inertia of 2.5 kg-m2 and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.2 kg-m2. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3 : 1. The automobile has a mass of 1600 kg and has its centre of gravity 0.5 m above road level. The width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. Assume that the road surface is not cambered and centre of gravity of the automobile lies centrally with respect to the four wheels. 10

Q:6 Answer the following Question.

(A) Derive two degree freedom model for sprung & unsprung mass. 05

(B) Define following terms in relation to damped vibrations: 05

1 Damping Factor 2. Logarithmic decrement 3. Critical damping co-efficient

OR

(A) A vibrating system consists of a mass 50 kg, a spring having stiffness 30 kN/m and a damper. The damping provides only 20 % of critical value. Determine:
a. The damping factor b. The critical damping coefficient c. Ratio of two consecutive amplitudes 05

(B) A body of 10kg mass is suspended from a spring with a scale k=1800 N/m. A dashpot is attached between the mass and the ground and has a resistance of 0.45N at a velocity of 0.05m/sec. Determine:(a) the damped linear frequency of the system (b) the critical damping co-efficient of the dashpot (c) the ratio of successive amplitudes 05

-----All the Best --------