Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER 2014

Subject Code: 170202 **Date: 03-06-2014**

Subject Name: Automobile system Design

Time:02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Describe the critical speed of propeller shaft. Also describe the role of whirling during the design of a shaft. **07**

(b) An automobile engine develops 25 kW at 1400 rpm and its bottom gear ratio is 3.15. If a propeller shaft of 40 mm outside diameter is to be used, determine the inside diameter of mild steel tube to be used, assuming a safe stress of 55000 kPa for the mild steel. **07**

Q.2 **(a)** Describe the weight transfer when the brakes applied to the rear wheels only. **07**

(b) A car using drum brakes has wheel cylinder pistons of 50 mm diameter at the front and 25 mm diameter at the back. The master cylinder piston is of 40 mm diameter. The leverage of brake pedal linkage is 4. If the driver applies a force of 100 N at the pedal, calculate braking force on each axle. Determine also the distance through which the pedal should be pressed so as to move the wheel cylinder pistons through 1 mm. **07**

OR

(b) A motor car has a wheel base of 2.64 m the height of its c.g. above the ground is 0.61 m and it is 1.12 m in frount of the rear axle. If the car is traveling at 40 km/hr on a level track, determine the maximum distance in which the car may be stopped, when (a) the rear wheels are braked, (b) the front wheels are braked, (c) all wheels are braked, **07**

Q.3 **(a)** Single plate friction clutch is to be designed for an Ashok Leyland bus developing 80.85 KW at 2400 r.p.m. The maximum torque developed however is 376 Nm at 1600 r.p.m. A maximum wear of clutch of clutch facing of 3 mm is to be allowed, when the clutch must transmit at least 25% excess torque. A pressure intensity of 190 kPa can be safely allowed and ratio inside dia / outside dia = 0.6 is considered reasonable. (1) Calculate clutch plate dimensions (2) If 9 springs are used and initial spring force is to be 1.2 times the spring force after allowable wear of 3 mm, find out the spring stiffness. Assume coefficient of friction as 0.35 **14**

OR

Q.3 **(a)** A plate clutch has three discs on the driving shaft and two discs on the driven shaft, providing four pairs of contact surfaces. The outside dia. of the contact surfaces is 240 mm and inside dia. Is 120 mm. Assuming uniform pressure and μ=0.3, find the total spring load pressing the plates together to transmit 23 KW power at 1575 r.p.m. If there are 6 springs each of stiffness 13 KN/m and each of the contact surfaces has worn away by 1.25 mm, Find the maximum power that can be transmitted, Assuming uniform wear. **14**

Q.4 **(a)** A semi-elliptical laminated vehicle spring to carry a load of 6000 N is to consist of seven leaves 65 mm wide, two of leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to the axle by U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume a design stress for spring material as 350 MPa. Determine: (1) Thickness of leaves, (2) Deflection of spring, (3) Diameter of eye, (4) Length of the leaves, and (5) Radius to which leaves should be initially bent. The standard thicknesses of leaves are: 5, 6, 6.5, 7, 7.5, 8, 9, 10, 11 etc. in mm **14**

OR

Q.4 **(a)** Describe Wahl's correction factor and state its importance in the design of helical springs. **07**

(b) A loaded narrow-gauge car of mass1800 kg and moving at a velocity 72 m/min is brought to rest by bumper consisting of two helical steel springs of square section. The mean diameter of the coil is six times the side of square section. In bringing the car to rest, the springs are compressed 200 mm. Assuming the allowable shear stress as 365 MPa and spring index of 6, Find: (1) Maximum load in each spring, (2) Side of the square section of the wire, (3) Mean diameter of coils, (4) Number of active coils. Take modulus of rigidity as 80 KN/mm2 **07**

Q.5 **(a)** Describe briefly: Johnson's method of optimum design. **07**

(b) Explain the laboratory testing method of following components of vehicle. **07**

1. Steering system
2. Automotive brake

OR

Q.5 **(a)** An engine develops 28 KW at 1800 r.p.m. when the torque is maximum. The bottom gear ratio is 3.2:1 and the back axle reduction is 4.6:1. The load on each driving axle is 7200 N when the car is fully loaded. Diameter of road wheel over the tyres is 0.70 m and the coefficient of adhesion between tyre and road is 0.6. If the permissible stress in the material of the shaft is not allowed to exceed 220725 KPa, find the diameter of the axle shaft. **07**

(b) Describe the front wheel alignment in vehicle. Also discuss in detail the Ackermann steering mechanism for automobile. **07**

****