Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(OLD) • EXAMINATION – WINTER 2016

Subject Code: 170202 Date: 21/11/2016

Subject Name: Automobile System Design

Time: 10:30 AM to 01:00 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)** A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100 kW at 2400 r.p.m. and maximum torque 500 N-m. The outer radius of the friction plate is 25% more than the inner radius. The intensity of pressure between the plate is not to exceed 0.07 N/mm^2. The coefficient of friction may be assumed equal to 0.3. The helical springs required by this clutch to provide axial force necessary to engage the clutch are eight. If each spring has stiffness equal to 40 N/mm, determine the dimensions of the friction plate and initial compression in the springs. **08**

(b) Design a propeller shaft for an automobile engine developing 30 kW at 1500 r.p.m. The bottom gear ratio being 3.2 and the ratio of external diameter of the propeller shaft and its internal diameter is 1.8. Assume a safe shear stress of 55 N/mm^2 for the material of shaft. **06**

Q.2 **(a)** Determine the cross-section of the leaves of a carriage spring of semi-elliptical shape, used as a suspension of a truck. There are 2 full-length leaves (including master leaf) and 8 graduated leaves. Spring eyes are located at 1180 mm. Take factor of safety as 2. Maximum load on spring may be taken as 40 kN. Take σ_{ut} for spring material = 1400 MPa. **08**

(b) Write short note on antilock braking system. **06**

OR

(b) List the various types of steering gear box and explain screw and nut steering gear box with neat sketch. **06**

Q.3 **(a)** A loaded narrow-gauge car of mass 1800 kg and moving at a velocity 72 m/min., is brought to rest by a bumper consisting of two helical steel springs of square section. The mean diameter of the coil is six times the side of the square section. In bringing the car to rest, the springs are to be compressed 200 mm. Assuming the allowable shear stress as 365 MPa and spring index of 6, find:
(1) Maximum load on each spring, (2) Side of the square section of the wire, (3) Mean diameter of coils, and (4) Number of active coils.
Take modulus of rigidity as 80 kN/mm^2 **08**

(b) Explain following:
(1) Brake efficiency (2) Braking ratio (3) Weight transfer **06**

OR

Q.3 **(a)** A centrifugal clutch consists of four shoes each having a mass of 1.5 kg. In the engaged position, the radius of the center of gravity of the shoes is 110 mm, while the inner radius of the drum is 140 mm. The coefficient of friction is 0.3. The pre-load in the spring is adjusted in such a way that the spring force at the beginning of engagement is 700 N. The running speed is 1440 r.p.m. Calculate:
(1) The speed at which the engagement begins; and
(2) The power transmitted by the clutch at 1440 r.p.m. **08**

	(b)	Explain: (1) Full floating axle (2) Half floating axle	**06**
Q.4	**(a)**	The load distribution between the front and the rear axle of a motor vehicle weighing 13.2 kN is such that 48% of the total load is taken by the front axle. The width of the track is 1.4 m and the distance between the centers of the spring pads is 0.66 m. Design a suitable I-section for the front axle assuming that the width of the flange and its thickness are 0.6 and 0.2 of the overall depth of the section respectively and the thickness of the web is 0.25 of the width of the flange. Assume a working stress of 90 N/mm^2.	**08**
	(b)	Derive the fundamental equation for correct steering.	**06**
		OR	
Q.4	**(a)**	Car weighing 1450 kgf makes an emergency stop at 94 km/hr. while using brakes on all wheels. The rolling and air resistance at 94 km/hr. is 82.5 kgf total. The coefficient of adhesion is 0.5. Calculate (1) the retarding force if the brakes are applied to locking point, (2) heat flow per minute at each wheel at the beginning of braking.	**08**
	(b)	Write short note on differential and final drive.	**06**
Q.5	**(a)**	Discuss Johnson's method of optimum design.	**08**
	(b)	Explain engine exhaust brake system.	**06**
		OR	
Q.5	**(a)**	Write short note on chassis dynamometer.	**08**
	(b)	Explain construction and working of hydraulic clutch system.	**06**

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