

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject Code: 170202**Date: 05-12-2013****Subject Name: Automobile System Design****Time: 10:30 TO 01:00****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) Prove that $R_1 / R_2 = 0.577$ for disc clutch to transmit maximum power using uniform wear theory. Where R_1 = inner radius of clutch and R_2 = outer radius of clutch **07**

(b) A track has pivot pins 1.37 mt apart, the length of each track arm is 0.17 mt and the track rod is behind front axle and 1.17 mt long. Determine the wheel base which will give true rolling for all wheels when the car is turning so that the inner wheel stub axle is 60° to the centre line of the car. **07**

Q.2 (a) State the requirements of good friction lining material for clutch. Describe the different material used for same with its properties. **07**

(b) Differentiate between drum brake and disc brake. **07**

OR

(b) State the names of different steering gear boxes. Explain any three with neat sketch stating its merit and limitations. **07**

Q.3 (a) Design a tensile bar of 200 mm length to carry a tensile load of 5000 N for minimum cost from material mentioned in table as under **10**

Material	Mass density Kg/m ³	Material cost Rs/N weight	Yield strength MPa
Steel	7500	16	130
Titanium alloy	4800	480	90
Magnesium alloy	2100	32	20
Aluminum alloy	3000	32	50

(b) State the parameters which are to be tested for an automobile on road. **04**

OR

Q.3 (a) A shaft is transmitting a torque of 1500 Nm. The torsional stiffness of the shaft should be 100 Nm/degree and the factor of safety is 2. Following table shows the materials under considerations. **10**

Material	Mass density N/cm ³	Yield strength MPa	Shear modulus MPa
Stainless Steel	0.11	230	84000
Chrome Steel	0.10	420	84000
Titanium alloy	0.06	910	42000
Magnesium alloy	0.02	224	12000

(b) Describe in brief the procedure of Johnson's method of optimum design. **04**

- Q.4 (a)** A car of all up-weight 14322 N is fitted with four wheel brakes and slowed uniformly from 86.5 km/h to 48 km/h in a distance of 152.5 m while running down an inclined of 1 in 15 slope. Calculate the amount of heat generated in kJ during this braking operation. If the front wheels share 55% of the braking forces, calculate the mean lining pressure in N/m^2 on the front wheel brakes from the following data: Brake drum diameter = 318 mm, Effective wheel diameter = 686 mm, Brake lining width = 50 mm, Lining area per drum = 32100 mm^2 , Co-efficient of friction between drum and lining = 0.35. Find the lining contact angle in each drum. **10**
- (b)** Explain in brief with neat sketch the working of torque tube drive. **04**
- OR**
- Q.4 (a)** A coil suspension spring has 10 effective coils of a mean diameter 125 mm and made out of spring wire diameter 15 mm having capability of taking maximum static load of 3.532 KN. Calculate the shear stress and the deflection under the said loading. If a maximum shear stress of 637.65 MPa is allowable in the material, then what is the possible clearance in the spring? Take $G = 73.575$ MPa. **10**
- (b)** Neatly sketch and label the Master cylinder. **04**
- Q.5 (a)** A semi-elliptical spring of a auto vehicle has 9 leaves including the master leaf. The span of spring is 950 mm. The load on the four spring is 10 KN. The allowable stress is 450 MPa. Assuming that the load on rear axle is 60% of total load, find the dimension of spring leaves if the maximum deflection of spring is not to exceed 80 mm. Take $E = 2.1 \times 10^5$ MPa. **10**
- (b)** Define the braking efficiency and explain weight transfer effect during braking. **04**
- OR**
- Q.5 (a)** A motor car has a wheel base of 2.64 m, the height of its CG above the ground is 610 mm and it is 1.12 m in front of the rear axles. If the car is travelling at 40 km/h on a level track, determine the minimum stopping distance in which the car may be stopped, when a) The rear wheels are braked, b) The front wheels are braked and c) All four wheels are braked. Take $\mu = 0.6$ **10**
- (b)** Explain the role of slip joint in propeller shaft. **04**
Propeller shaft is made hollow-why?
