Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 170202 **Date: 31/12/2012**

Subject Name: Automobile System Design

Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

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

Q.1 **(a)** Design a propeller shaft for an automobile engine developing 50 kW at 2200 r.p.m. The bottom gear ratio being 4.3 and ratio of external diameter of the shaft and its internal diameter is 1.8. Take a safe shear stress of 56 N/mm^2 for the material of shaft. **08**

(b) Explain the working of hydraulic clutch system. **06**

Q.2 **(a)** Design a suitable I-section for the front axle assuming the following data: **08**

Total weight of car = 9600 N
Wheel track = 1470 mm
Distance between the centers of spring pads = 750 mm
Load taken by front axle = 45% of total weight of car
Working stress = 95 N/mm^2
Width of flange and thickness are 0.6 and 0.2 of the overall depth of section
Thickness of the web = 0.25 of width of flange

(b) Explain Anti-lock braking system. **06**

OR

(b) Write short note on chassis dynamometer. **06**

Q.3 **(a)** A single plate clutch, consisting of two pairs of contacting surfaces, is required to transmit 40 kW power at 1560 r.p.m. The outer diameter of the friction disk is limited to 300 mm. The coefficient of friction between the contacting surfaces is 0.3 and the intensity of pressure is limited to 0.4 N/mm^2. Assume uniform wear condition and service factor is 1.25, Determine: **08**

(i) The inner diameter of friction disk
(ii) Axial force required to engage the clutch

(b) Explain telescopic type shock absorber. **06**

OR

Q.3 **(a)** A centrifugal clutch with four shoes is used to transmit 12 kW at 730 r.p.m. The speed at which engagement begins is 80% of full speed. Inner diameter of the drum is 320 mm and CG of each shoe is radially at a distance of 130 mm from axis of shaft. Coefficient of friction between friction lining and drum is 0.25. The pressure exerted on shoe during engagement is 0.1 MPa. Determine: **08**

(i) Mass of each shoe
(ii) Size of the shoe if the angle subtended by shoe at center is 60°.

(b) List the various types of universal joints and explain any one. **06**

Q.4 **(a)** The following data is given for a caliper disk brake with annular pad for the **08**

front wheels of sports car.
Torque capacity = 450 N-m
Outer radius of pad = 150 mm
Inner radius of pad = 100 mm
Coefficient of friction = 0.4
Average pressure on pad = 1.1 N/mm^2
Determine the required number of pads, if
The pads are annular segments with subtended angle of 60° per pad at the center of disk.

(b) Explain construction and working of differential unit. **06**

OR

Q.4 (a) A vehicle with wheel base 2.14 m and front wheel track 1.22 m is provided with Ackermann steering system. The distance from the center plane of each front wheel to the nearest king pin axis is 0.11 m. while taking a turn; the inner front wheel is deflected through a maximum angle of 42°. Calculate the corresponding deflection of the outer front wheel, assuming that all the wheels are in true rolling motion. Also, find the turning radius of the outer front wheel and inner rear wheel. **08**

Q.4 (b) With the help of neat sketch, explain the working of internal expanding shoe brake. **06**

Q.5 (a) A semi-elliptic multi-leaf spring is used for the suspension of the rear axle of truck. It consists of two extra full leaves and eight graduated leaves including the master leaf. The center distance between the two eyes of the spring is 1.1 m. The maximum spring force acting on the spring is 12 kN and the width of each leaf is 60 mm. The spring is pre-stressed so as to equalize stresses in all leaves. If the stresses induced corresponding to maximum load are equal to 350 MPa and the modulus of elasticity of the leaf spring is 200 GPa, Determine: **08**

(i) The thickness of the leaves
(ii) Deflection of spring at maximum load

(b) Write short note on power steering. **06**

OR

Q.5 (a) Explain Johnson's method of optimum design with suitable example. **08**

(b) Write the advantages and disadvantages of Independent suspension system **06**

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