Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIIth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 170202 **Date: 08/06/2012**

Subject Name: Automobile system design

Time: 02:30 pm – 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)** Explain design considerations for the clutch and also explain the selection considerations for the clutch. **07**

(b) A vehicle weighing 6 tones has its C.G. 1.0 m in front of the rear axle , 1.6 m behind the front axle and 1.25 m above the ground level . The front wheel brakes are having only leading shoes and where as the rear wheel brakes have conventional leading and trailing shoes. Equal actuating forces are applied to all the shoes which are symmetrically placed.Having brake drum diameter = 220 mm. Distance of shoe pivots from the drum axes = 900 mm. Distance of line of acting of the actuating forces from the drum axes = 100 mm. Effective radius for the resultant frictional force = 160 mm . Co efficient of friction = 0.4. Diameter of road wheels = 900 mm. Co efficient of adhesion for the road = 0.5.Calculate (a) the magnitude of actuating force on each shoe , and (b) the max. deceleration possible without any skidding of the wheels. **07**

Q.2 **(a)** Explain propeller shaft assembly testing for balancing. **07**

(b) A torsion bar suspension is to be designed to support a maximum static load of 3433.5 N at the end of a lever arm 250mm long. The deflection of the lever above the horizontal is to be 30 degree with a total angle of deflection of 90 degree . Assume a safe allowable stress of 784800 kPa calculate **07**

(a) The diameter of the torsion bar
(b) The effective length
(c) The load rate.

OR

(b) The distance between the king pins of a car is 1.3 m . The track arms are 0.1525 m long and the length of the track rod is 1.2 m . For a track of 1.42 m and a wheel base of 2.85 m find the radius of curvature of the path followed by the near side front wheel at which correct steering is obtained when the car is turning to the right. **07**

Q.3 **(a)** State the Design steps for the fully floating and dead axle. **07**

(b) State and Explain design considerations for belleville spring, elastomeric spring and air spring **07**

OR

Q.3 **(a)** Explain the meaning of (with respect to brake) **07**

(1) Mechanical
(2) hydraulic
(3) Air brake system
(4) vacuum servo assisted brake
(5) antilock brake
(6) engine exhaust brake
(7) regenerative brake
8) fail safe brake system

(b) In a hydraulic single line braking system force on foot pedal is 100 N pedal leverage ratio is 4 , cross sectional area of master cylinder is 4 cm^2 , cross sectional area of front pistons 20 cm^2 , cross sectional area of rear piston 5 cm^2 , and distance moved by effort is 1 cm **07**

Calculate:

(a) Front to rear brake ratio
(b) Percentage of front and rear braking
(c) Total force ratio
(d) Distance moved by output
(e) Cylinder movement ratio and
(f) Total movement ratio

Q.4 **(a)** Explain types of suspension springs based on their application and give comparison between them. **07**

(b) Define and Explain the following terms : **07**

(1) Ride characteristic on different road surfaces
(2) Ride comfort
(3) Correction testing

OR

Q.4 **(a)** Explain the Design arrangement for various types of steering gear box arrangements. **07**

(b) Explain propeller shaft assembly testing for balancing. **07**

Q.5 **(a)** Explain vehicle testing on chassis dynamometer , brake testing on road and hill climbing. **07**

(b) In a light weight equipment a shaft is transmitting a torque of 900 Nm and is to have rigidity of 90 Nm/degree . Assume a factor of safety of 1.5 based on yield stress . Design the shaft with minimum weight. What will be the change in design for minimum cost. Assume maximum shear stress theory of failure. Use of the following data of the materials: **07**

Material	Mass Density(kg/m^3)	Material cost (Rs / N Weight)	Yield Strength(MPa)	Shear modulus(GPa)
Steel alloy	8500	16	130	80
Al alloy	3000	32	50	26.7
Titanium alloy	4800	480	90	40
Magnesium alloy	2100	32	20	16

OR

Q.5 **(a)** Explain step by step johnson's method of optimum design. **07**

(b) A truck weighs 100111N and the engine develops 97 b kW at 2400 rpm. The transmission efficiency is 90% in the top gear of 3.4:1 and 85% in the third gear of 8.4:1 . the performance of the vehicle is such that it will just reach a speed of 86.8 km /h at 2400 rpm at wide open throttle when running on the level in still air , and at the same engine speed in third gear it will just climb a gradient of 1 in 14 . If the total resistance in N is given by the formula **07**

$$R= KW + K_aAV^2 + W\sin\theta ,$$

Where A is in m^2 V in km/h and W in N , calculate K and K_a and hence the engine power required for climbing a grade of 1 in 40 at 48 km/h in top gear . how much weight can be added to the vehicle to use the engine power fully under the above condition.

Front area of truck = $5.575m^2$.

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