

Total No. of Questions : 12]

SEAT No. :

P750

[Total No. of Pages : 4

[4659] - 372

B.E. (Automobile Engineering) (Semester - I)

AUTOMOBILE SYSTEM DESIGN

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Solve Any 3 questions from each section.*
- 2) *Answers to the two Sections should be written in separate answer-books*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

SECTION - I

- Q1)** a) What do you understand by optimum and adequate design. [4]
b) Explain in brief Johnson's method of optimum design. [6]
c) A hollow shaft is required to transmit 600 kw at 110 r.p.m., the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 Mpa and twist in a length of 3 meteres not to exceed 1.4 degrees. Find the external diameter of the shaft ,if the internal diameter to external diameter is 3/8. Take modulus of rigidity as 84 GPa. [8]

OR

- Q2)** a) What are the aesthetic and ergonomic consideration in design. [6]
b) Explain optimization techniques in design. [6]
c) Write a short note on Design for natural tolerances. [6]

- Q3)** a) State and explain friction materials used in clutches. [4]
b) A single dry plate clutch is to be designed to transmit 10HP at 900 RPM. [12]

Find-

- i) Diameter of the shaft
- ii) mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4.
- iii) outer and inner radii of the clutch plate
- iv) Axial force required to engage the clutch

P.T.O.

OR

- Q4) a)** What is the requirement of a clutch? [4]
- b) A centrifugal clutch is to be designed to transmit 20HP at 900 rpm. The shoes are four in number. The speed at which the engagement begins is $\frac{3}{4}$ th of the running speed. The inside radius of the pulley rim is 15 cm. The shoes are lined with Ferodo for which the coefficient of friction may be taken as 0.25. Determine: [12]
- i) weight of the shoes.
- ii) Size of the shoes

- Q5) a)** Explain gear boxes with different speed gears. [4]
- b) Design a 3 speed constant mesh gear box having a gear ratio of 3.6 in bottom and reverse gear. The main shaft and lay shaft are 12cm apart approximately. Take the module 3.25mm. The top gear has got unity gear ratio. Find the exact gear ratio. [12]

OR

- Q6) a)** Explain the selection of gearboxes bearing in gearboxes. [6]
- b) A four speed gear box is to have the following gear ratios, 1.0, 1.5, 2.48 and 3.93. The centre distance between the layshaft and the main shaft is 73.12 mm and the smallest pinion is to have at least 12 teeth with a diametral pitch of 3.25mm. Find the number of teeth of the various wheels. Find the exact gear ratios. [10]

SECTION - II

- Q7) a)** State and explain the types of live axle. [6]
- b) A hollow propeller shaft of a car with outside diameter 75 mm transmits 22.5 kw at 1500 rpm. to the wheels which are 90 cm in the diameter. If the allowable shear stress is 60 N/mm², find out the cross-section of shafts. Take gear box reduction 5. [10]

OR

OR

- Q8)** a) What should be characteristics of a propeller shaft? [3]
- b) Why propeller shafts are made hollow? [3]
- c) The rear axle shaft connecting differential to side wheel is required to transmit 30 Kw at 1500 rpm. If maximum torque is two times average torque and $f_s = 80 \text{ N/mm}^2$ for axle material, find out diameter of axle shaft if,
- i) Shaft is solid.
- ii) Shaft is hollow with outside diameter 1.5 times the inside diameter. [10]

- Q9)** a) Explain braking of a vehicle on a curved path. [4]
- b) A motor cycle has wheel base 1.44m apart. The centre of gravity of the cycle and the rider is 0.76m above ground level 0.61m in front of the rear axle the coefficient of friction between the tyre and road is 0.75. If the rear wheel is brake, find the greatest deceleration that can be obtained.
- i) If the cycle is moving in a straight path
- ii) If it is going round a curve of 45.7m radius at 48km/hr
- Assume a level road and neglect air resistance. Neglect rotational inertia and obliquity when turning. [12]

- Q10)** a) Calculate the mean lining pressure and heat generated during braking operation. [8]
- b) Prove that when a passenger with a wheel base equal to 5 times the height of centre of gravity about the ground point is brake to utilize all the road friction availability ($\mu = 0.6$) the weight transferred from rear to front wheels amounts to approximately 12% of the weight of the car. [8]

Q11)a) Explain in brief understeer and oversteer. **[8]**

b) A truck spring has 12 no. of leaves 2 of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 N/m². Determine the thickness and the width of steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring. **[10]**

OR

Q12)a) Explain components of steering system. **[12]**

b) State and explain any one steering gear mechanism. **[6]**

