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Question Paper Code : 51099

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Sixth Semester

Automobile Engineering

AT 2352/AU 62/10122 AU 603 — AUTOMOTIVE CHASSIS COMPONENTS
DESIGN

(Regulation 2008/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the main considerations in the design of vehicle frames?
2. What is a variable rate leaf spring?
3. What is king-pin inclination?
4. What should be the characteristics of steering linkage arrangements?
5. What happens if the diameter of the driven plate is increased?
6. What are the parameters that limit the torque capacity of a friction clutch?
7. How are intermediate gears decided?
8. What are the frequently used typical over drive ratios?
9. Compare the location of outer end shaft and hub bearing in semi floating and three quarter floating axle.
10. What is the purpose of rear axle final drive?

PART B — (5 × 16 = 80 marks)

11. (a) A vertical chassis can be considered as a simple supported beam of 5m long and is supported at A and B each being 1.0 m from its front and rear ends. Loads of 3kN and 6kN are carried 0.5m in front of A and 2m behind A respectively.
- Find the magnitude of the reactions at A and B
 - If an extra load of 5kN is to be added to the beam in such a position that the reactions at A and B are to be equal, what will these reactions can be, and what distance from A must the 5kN load be situated? (16)

Or

- (b) A torsion bar suspension is to be designed to support a maximum static load of 3433.5N at the end of the lever arm 250mm long. The deflection of the lever above the horizontal is to be 30° with a total angle of deflection of 90°. Assuming a safe allowable stress of 784800kPa, calculate
- The diameter of the torsion bar
 - The effective length and
 - The load rate. (16)
12. (a) 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. (16)

Or

- (b) Distinguish between reversible and irreversible steering. Briefly explain the function of steering gearbox. Sketch a typical steering gearbox and name its components. 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 centre plane of each front wheel to the nearest king-pin 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 wheels are in true rolling motion. Also find the turning radius of the outer front wheel. (16)
13. (a) A cone clutch is to transmit 7.36kw at 750rpm, the normal intensity of pressure between the contact face is not to exceed $11.8 \times 10^4 \text{ N/m}^2$. The coefficient of friction is 0.2. If face width is $1/5^{\text{th}}$ of the mean diameter, find
- The main dimensions of the clutch and
 - Axial force required while running. (16)

Or

- (b) A passenger car has a single disc type of friction clutch and is powered by an engine, which develops a torque of 113 Nm. The inside diameter of the friction facing is 0.6 times outside diameter. Permissible unit pressure on the friction facing is 240kPa. Coefficient of friction of facing with contacting member is 0.3. Assume suitable values for any further data required, if any. Calculate the outside and inside diameter of the friction facing. (16)
14. (a) A four speed gearbox is to have the following gear ratios, 1.0, 1.5, 2.48 and 3.93. the centre distance between the lay shaft and the main shaft is 73.12mm and the smallest pinion is to have at least 12 teeth with a diametrical pitch of 3.25mm. Find the number of teeth of various wheels. Find the exact gear ratios. (16)

Or

- (b) The maximum gear box ratio of an engine 75 mm bore and 100mm stroke is 4. The pitch diameter of the constantly meshing gear is 75% of the piston stroke. If the module is 4.25mm, calculate the size and number of teeth of gears for a three speed gear box. Calculate the face width of the constantly meshing gear using the modified Lewis formula. The engine torque is 910kgf-cm, value of constant in Lewis formula is 0.07 and the allowable stress is 900kgf/cm². Draw the neat sketch of the three speed gear layout. (16)
15. (a) (i) An automobile engine develops 28kw at 1500 rpm and its bottom gear ratio is 3.06. If a propeller shaft of 40mm outside diameter is to be used, determine the inside diameter of mild steel tube to be used, assuming a safe shear stress if 55×10^3 Kpa for the MS. (8)
- (ii) Two shafts are connected by a universal joint. The driving shaft rotates at a uniform speed of 1200 rpm. Determine the greatest permissible angle between the shaft axes so that the total fluctuation of speed does not exceed 100 rpm. Also calculate the maximum and minimum speed of the driven shaft. (8)

Or

- (b) Sketch a semi-floating type rear axle construction and name its components. Mention the loads and stresses acting on the axle shaft of a semi-floating type rear axle. An axle shaft has to be designed for a full floating rear axle. Given: Maximum engine torque is 195 Nm, Rear axle ratio is 5:1, Gear ratio are 4:1, 2.5:1, 1:4 and 1:1. Permissible shear stress for the axle material is 13734 N/m². Calculate the diameter of the axle shaft. (16)