KUMARAGURU
college of technology
character is life

B.E DEGREE EXAMINATIONS: NOV / DEC 2014

(Regulation 2009)

Sixth Semester

AUTOMOBILE ENGINEERING

AUE 112: Chassis Design

(P S G Design Data Book and Approved Design Data books are permitted)

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Chassis frame is made of _____ material.

    a) Cold Rolled heat treated alloy steel   b) Cold Rolled heat treated Mild steel

    c) Cast iron   d) HSS

2. Maximum bump load is _____% of the maximum Static Load

    a) 65   b) 165

    c) 50   d) 150

3. Which is correct steering equation?

    a) $\text{Sin}(\alpha+\theta)+ \text{Sin}(\alpha-\varphi)= 2 \text{Sin } \alpha$ b) $\text{Sin}(\alpha-\theta)+ \text{Sin}(\alpha+\varphi)= 2 \text{Sin } \alpha$

    c) $\text{Sin}(\alpha-\theta)+ \text{Sin}(\alpha+\varphi)= \text{Sin } \alpha$ d) $\text{Sin}(\alpha+\theta)+ \text{Sin}(\alpha-\varphi)= \text{Sin } \alpha$

4. Turning Circle Radius means

    a) Making Longest Turning Radius of the   b) Making Shortest Turning Radius of the
        vehicle   vehicle
    c) Turning radius of Front inner Wheel   d) Turning radius of Front outer Wheel

5. Which assumption gives better result during power transmission on Clutch?

    a) Uniform of pressure   b) Uniform rate of Wear

    c) Static   d) All the above

6. The rate of wear depends upon _____between the contact surfaces.

    a) Intensity of pressure   b) Rubbing velocity

    c) Load   d) Both (a) &(b)

7. Find the progression ratio for a 6 speed gear box having speeds between 160 and 500 r.p.m.

    a) 1.22   b) 1.56

    c) 1.122   d) 1.256

8. The transmission ratio(i) in a gear box is limited by

   a) $i_{max} \leq 2$ b) $i_{max} \leq 4$

   c) $i_{max} \leq 3$ d) $i_{max} \leq 8$

9. Critical speed of the propeller shaft is

   a) $\dfrac{60\pi^2}{2\pi l^2}\sqrt{\dfrac{EI}{\rho A}}$ b) $\dfrac{60\pi^2}{2\pi l}\sqrt{\dfrac{EI}{\rho A}}$

   c) $\dfrac{60\pi}{2\pi l^2}\sqrt{\dfrac{EI}{\rho A}}$ d) $\dfrac{60\pi^2}{2\pi l^2}\sqrt{\dfrac{EI}{A}}$

10. Fully floating axle hub is used for

    a) Heavy vehicle   b) Three wheeled vehicle

    c) Cars   d) All the above

PART B (10 x 2 = 20 Marks)

11. What are the various major loads acting on the chassis frame?

12. What is torsion bar?

13. A track has pivot pins 1.37 m apart, the length of each track arm is 0.17 m and the track rod is behind the front axle and 1.17 m 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.

14. What are the functions of Front Axle?

15. Why is a cone clutch more effective than plate clutch?

16. Classify Clutch.

17. Select spindle speeds, for 9 speeds gear box, between 80 and 1285 r.p.m.

18. What are the requirements of a speed gear box?

19. Why is a tubular-section propeller shaft normally used?

20. A vehicle has a third gear ratio of 1.5 to 1 and a rear axle ratio of 4.5 to 1. Calculate (a) the overall gear ratio and (b) the number of revolutions made by the crown wheel per minute if the engine speed is 2700 rpm.

PART C (5 x 14 = 70 Marks)

21. a) A vertical chassis can be considered as a simply supported beam of 5 m long and is supported at A and B each being 1.0 m from its front and rear ends. Loads of 3 kN are carried 0.5m in front of A and 2 m behind A respectively.(i) Find the magnitude of the reactions at A and B.(ii)If an extra load of 5 kN 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 reaction can be, and at what distance from A must the 5 kN load be situated?

(OR)

b) (i) Design Torsion Bar. (7)

(ii) A torsion –bar suspension is to be designed to support a maximum static load of (7) 3433.5 N at the end of lever arm 250 mm long. The deflection of the lever above the horizontal is to be 30° with a total deflection of 90^0. Assuming a safe allowable stress of 784800 kPa, Calculate (a) the diameter of the torsion bar, (b) the effective length and (c) the load rate.

22. 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 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.

(OR)

b) (i) Drive the equation for correct steering angle. (7)

(ii) What are the forces and Reactions acting on the front axle Steering Knuckle? (7) Calculate the Reaction Forces.

23. a) A plate clutch has three discs on the driving shaft and two discs on the drive shaft, providing four pairs of contact surfaces. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and $\mu = 0.3$, find the total spring load pressing the plates together to transmit 23kW power at 1475 revolution per minute.

If there are 6 springs each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted, assuming uniform wear.

(OR)

b) Following data relate to a cone clutch :

Maximum contact surface radius = 140 mm

Minimum contact surface radius = 125 mm

Semi cone angle = 20^0

Coefficient of fraction = 0.25

Allowable normal pressure = 137.34 kPa

Estimate   (i)   the axial load and

               (ii)   Power transmitted at 1000 rpm

24.   a)   A gear box is to be designed to provide 12 output speeds ranging from 160 to 2000 rpm. The input speed of motor is 1600 r.p.m. Using step ratio, draw the speed diagram, and the kinematic layout. Also find and fix the number of teeth on all gears.

(OR)

b)   Sketch the arrangements of a six speed gear box. The minimum and maximum speeds required are around 460 and 1400 rpm. Drive speed is 1440 rpm. Construct speed diagram of the gear box and obtain various reduction ratios. Use standard output speeds, standard step ratio draw the speed diagram, and the kinematic layout. Calculate number of teeth in each gear.

25.   a)   A six cylinder four stroke cycle engine with a capacity of 2130 cm^3 is operating at 4500 rpm and developing 560kN/m^2 BMEP. If the final drive ratio is 5.2 : 1 and the transmission efficiency in top gear is 90%, determine the power at the road wheels when top gear is engaged. If this vehicle is negotiating a road bend and the inside road wheels are making 230 rpm, calculate the rpm of the outer wheels and the torque and power at outer and inner wheels.

(OR)

b)   An engine develops 30 kW at 2000 rpm when the torque is maximum. The bottom gear ratio is 3: 1 and the back axle reduction is 4.5: 1. The load on each driving axle is 0.75 tonne, when the car is fully loaded. Diameter of the road wheel over the tyre is 71 cms. The maximum permissible shear stress is 120 $N/mm^{2.}$. The maximum permissible bending stress is 280 N/mm^2. If three quarter floating axle is used, design.

      a.   Axle Shaft.

      b.   Axle housing of the value of inside diameter 0.8 times outside diameter and the distance between spring seat and centre Plane of wheel is 0.22 m.

****