



B.E DEGREE EXAMINATIONS: APRIL 2015

(Regulation 2009)

Sixth Semester

AUTOMOBILE ENGINEERING

AUE 112: Chassis Design

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Application of space frames
 - a) Used for two wheelers
 - b) Used for race cars
 - c) Used for trucks
 - d) Used for three wheelers
2. What is the formula for deflection in coil spring?
 - a) $\frac{\pi D^2 n f_z}{Gd}$
 - b) $\frac{\pi D^3 n f_z}{G}$
 - c) $\frac{D^2 n f_z}{Gd}$
 - d) $\frac{D^2 n}{Gd}$
3. Which is correct steering equation?
 - a) $\sin(\alpha+\theta)+\sin(\alpha-\phi)=2\sin\alpha$
 - b) $\sin(\alpha-\theta)+\sin(\alpha+\phi)=2\sin\alpha$
 - c) $\sin(\alpha-\theta)+\sin(\alpha+\phi)=\sin\alpha$
 - d) $\sin(\alpha+\theta)+\sin(\alpha-\phi)=\sin\alpha$
4. In Front Axle beam is manufactured from _____ material.
 - a) Cast Iron
 - b) HSS
 - c) MS
 - d) Alloy forged steel
5. Torque transmitting capacity of clutch depends upon
 - a) Coefficient of friction
 - b) Dimension of friction lining
 - c) Axial force provided to engage the clutch
 - d) Material of the friction lining
6. The clutch used in truck is
 - a) Centrifugal clutch
 - b) Cone Clutch
 - c) Multi-Plate Clutch
 - d) Single Plate Clutch

7. The ratio between the two adjacent speeds is known as _____
 - a) Step ratio
 - b) Series ratio
 - c) Progression ratio
 - d) All of the above
8. Find the progression ratio for a 12 speed gear box having speeds between 100 and 355 r.p.m.
 - a) 1.22
 - b) 1.06
 - c) 1.122
 - d) 1.2866
9. Propeller shaft is also called as _____
 - a) Crank Shaft
 - b) Carden Shaft
 - c) Cam Shaft
 - d) Final drive shaft
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 types of frame?
12. Define Rate of Spring
13. What are the types of stresses encountered by front axle?
14. 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.
15. What are the main functions of an Automobile Clutch?
16. What are the combination of friction materials used for clutch plate?
17. What are the requirements of a speed gear box?
18. Find the progression ratio for a 12 speed gear box having speeds between 100 and 355 r.p.m.
19. Why is a tubular-section propeller shaft normally used?
20. Why differential is necessary?

PART C (5 x 14 = 70 Marks)

21. a) Calculate the maximum bending moment and maximum section modulus assuming the following particulars.

Wheel base = 180cm

Overall length = 360 cm

Equal overhang on either side.

2700N acting at CG of load 45cm in front of front axle.

1800N acting at CG of load 45cm in behind front axle.

1800N acting at CG of load 45cm in front of front rear axle.

67.5N acting at CG of load 45cm behind the rear axle.

In addition there is a uniformly distributed load of 17.5N per cm run over the entire length of the chassis. Assume allowable stress in the material is 6kN/cm^2

(OR)

- b) A vehicle spring of semi-elliptic type has leaves of 75 mm width and 10 mm thickness and effective length 900 mm. If the stress is not to exceed 220725 kPa when the spring is loaded to 4905 N, estimate the required number of leaves and the deflection under this condition. If the spring is just flat under load. Design the Leaf Spring. Take $E=196.2 \times 10^6\text{kPa}$.

22. a) (i) What are the forces and Reaction acting on the front axle Steering Knuckle? (10)
Calculate the Reaction Forces.
- (ii) A motor car has a wheel base of 2.743 m and pivot centre of 1.065 m. the front and rear wheel track is 1.217 m. Calculate the correct angle of outside lock and turning circle radius of the outer front and inner rear wheels when the angle of inside lock is 40° . (4)

(OR)

- b) The distance L between the pivots of a car is 1.17m.the knuckle arms 0.165 m long. The angle between the knuckle arm and the longitudinal axis of the car in the straight ahead position is 20° . The tread is 1.42 m and L is 45% of the wheelbase. Find the radius of the path near side front wheel for the correct steering to the right.

23. a) A plate clutch has three discs on the driving shaft and two discs on the driven 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 23 kW power at 1475 revolution per minute. If there are 6 springs each of stiffness 13 kN/m 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) A centrifugal clutch is to transmit 14.72 kW at 900 rpm. The shoes are four in number. The speed at which the engagement begins is $3/4^{\text{th}}$ of the running speed.

The inside radius of the pulley rim is 150mm and the centre of gravity of the shoe lies at 120 mm from the centre of spider. The shoes are lined with Ferrodo for which the coefficient of friction may be taken as 0.25. Determine,(a)Weight of the shoe (b)Size of the shoe if angle sustained by the shoes, at the centre of spider is 60° and the pressure exerted on the shoes is $9.81 \times 10^4 \text{ N/m}^2$

24. a) A nine speed gearbox, used as a head stock gear box of a turret lathe, is to provide a speed range of 180 r.p.m to 1800 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) 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.

25. a) Explain the distribution of bending moment produced by bearing load on semi-floating axle housing.

(OR)

- b) A six cylinder four stroke cycle engine with a capacity of 2130 cm^3 is operating at 4500 rpm and developing 560 kN/m^2 BMEP. If final 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.
