Register Number: ……………………..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Sixth Semester

AUTOMOBILE ENGINEERING

AUE112: Chassis Design

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

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. The various chassis member cross section shapes
   a) Solid round rectangular cross section
   b) Open thin walled channels(C, I section etc..)
   c) Hollow round or rectangular box section
   d) All of the above

2. When the helper springs on commercial vehicles share the loads in addition to the main leaf springs?
   a) When the vehicle is light loaded
   b) When the vehicle is fully loaded
   c) When the vehicle is partly loaded
   d) When the vehicle is no load

3. Function of a shackle as used in a leaf spring is to
   a) Control sideway
   b) Allow the spring end to pivot
   c) Allow the spring length to change
   d) All of the above

4. A torsion bar is also called
   a) Stabilizer bar
   b) Panhard Rod
   c) Radius rod
   d) Strut rod

5. An automobile clutch is normally designed to transmit torque that is
   a) Maximum engine torque
   b) 150 % of the engine torque
   c) 90 % of the maximum engine torque
   d) Minimum engine torque

6. The coefficient of friction of an automobile clutch facing about
   a) 1.2
   b) 0.12
   c) 0.82
   d) 0.42

7. In a 4-speed manual transmission without overdrive, which "gear" would have a 1:1 ratio?
   a) First
   b) Second
   c) Third
   d) Fourth

8. Torque multiplication in a torque convertor is greater at what speed?
   a) Start-up Stall
   b) Crushing speed
   c) High speed
   d) Low speed

9. Inner end of the axle shaft is splined to the
   a) Sun gear
   b) Differential cage
   c) Planet pinion
   d) Crown wheel

10. The type of rear axle used on trucks is
    a) Semi-floating
    b) Three-quarter floating
    c) Fully-floating
    d) Elliot type rear axle

PART B (10 x 2 = 20 Marks)

11. What are the loads and moments acting on a frame?

12. Why are leaf spring used in commercial vehicles?

13. Write the fundamental condition for the true rolling motion of all types of steering system

14. For a front axle, why do we have I-section in the middle and elliptical section at its ends?

15. What is the major factor limiting clutch capacity?

16. What is a clutch needed in an Automobile transmission system?

17. Why is geometric progression preferred in a gear ratio?

18. What is tractive resistance?

19. Why is hollow shaft used as propeller shaft?

20. Define "whirling" of shafts.

PART C (5 x 14 = 70 Marks)

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

    Wheel base=190 cm, Overall length=380 cm

    Equal overhang on either side

    i) 2800N load corresponding to engine is acting 50 cm in front of front axle.

    ii) 1950N load corresponding to passenger is acting 50 cm behind the front axle.

    iii) 1950N load corresponding to passenger is acting 50 cm in front of rear axle

    iv) 700N load corresponding to luggage is acting 50 cm behind the rear axle.

    In addition, there is a UDL of 1.75N/mm run over the entire length of the chassis frame.

    Assume dynamic stress=2X Static stress

    Maximum bending stress=60N/mm^2

(OR)

b) A torsion bar suspension is to be designed to support a maximum static load of 3500N at the end a lever arm 25 cm long. The deflection of the lever above the horizontal is to be 30^0 with a total angle of deflection of 90^0. Assuming a safe allowable stress of 800N/mm^2, calculate

    i) Diameter of torsion bar

    ii) Effective length

    iii) The load rate

22. a) The load distribution between the front and rear axle of a vehicle weighing 13,500N is that 48% of the total load is taken by the front axle. The front wheel track is 140 cm and the distance between the centre of the spring pad is 66 cm. Design a suitable I- section for the front axle, assuming that the width of the flange and its thickness are 0.6 and 0.2 of the overall depth of section and the thickness of the web is 0.25 of the width of flange. Assuming a working stress of 91.5N/mm^2

(OR)

b) What is steering error curve? What is its significance in steering system design? Further derive the fundamental condition for the true rolling motion of all the wheels of a vehicle.

23. a) A cone clutch with cone angle 20^0 is to transmit 7.30 Kw at 750 rpm. The normal intensity of pressure between the contact faces is not to exceed 11.8×10^3 N/m^2. The coefficient of friction is 0.2. If the face width is 1/5 of the mean diameter, Find out the main dimensions of the clutch and the axial force required while running.

(OR)

b) Calculate the inner and outer radius of the friction lining of a single plate two sided dry type clutch and the axis spring thrust exerted by the clutch springs to keep it engaged from the following data:

Maximum torque transmitted=13.56N-m

Co-efficient of friction surface=0.3

Maximum axial pressure=8.29X10^4 Pa

External radius of friction surface=1.25 times internal radius.

24. a) A sliding mesh type gear box with forward speed only is to be designed. The gear box should have the following gear ratio Via, 1.0, 1.5, 2.5 and 3.9. The centre distance between the lay shaft and main shaft is 78 mm and the smallest pinion is to have at least 16 teeth with increase diametral pitch of 3.25 mm. Find the number of teeth of the various gears and the exact gear ratios available.

(OR)

b) A nine speed gearbox is to provide a speed Range of 180 r.p.m. using step ratio, draw the speed diagram, and the kinematic layout. Also find the number of teeth on all gears.

25. a) The outer diameter of a hollow cylindrical propeller shaft d_0 = 5.80 cm. The length of the propeller shaft L=130 cm. Maximum engine torque 265 N-m. Maximum engine power occurs at 3325 rpm. First gear ratio is 3.10, Rear axle ratio is 4.10. Permissible value of fs=180 N/mm^2 for the propeller shaft material. Calculate the inner diameter of the propeller shaft. Also ascertain whether the critical speed of propeller shaft is within safe limits.

(OR)

b) (i) Sketch and name the components of a semi-floating type rear axle. List the loads (7) and stresses acting on this type of rear axle.

    (ii) Design a full floating rear axle from the following data (7)

      Maximum engine torque=196N-m

      Rear axle ratio=5.1

      Gear ratios=4:1, 2.5:1, 1.4:1 and 1:1

      Permissible shear stress for the axle shaft material=13734N/m^2

      The diameter of the shaft alone is to be found out.

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