

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2181915

Date: 15/11/2018

Subject Name: Automobile Engineering

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) Point out need of clutch in the automobile. **03**
- (b) Tyre designation is 145/70 R 12 69 S. Tell meaning of each letter and number held in this designation. **04**
- (c) Discuss in detail various requirements of automobile body. **07**

- Q.2**
- (a) Define terms: **03**
1. Simple structured surface
 2. Tractive effort
 3. Gradiability
- (b) The differential shown in Figure 1 has a number of teeth on the bevel pinion and on the crown wheel as 10 and 50 respectively. (a) Calculate the rotational speed of the differential cage. (b) If the propeller shaft is rotating at 1000 r.p.m., what is the speed of the road wheel driven by gear A relative to the road wheels driven by gear B? **04**
- (c) Explain construction and working of hybrid car with neat diagram. **07**

OR

- (c) Explain longitudinal load due to traction and braking and derive equation for reactions for (a) front wheel drive acceleration (b) rear wheel drive acceleration and (c) braking with neat diagram **07**
- Q.3**
- (a) List mainly three components of propeller shaft with their function. **03**
- (b) Two shafts A and B, whose axes are intersecting but inclined to each other at 15° (α) are connected by means of a Hook's joint. A flywheel of weight 180 kN and radius of gyration 80 mm is fitted to shaft B. If the shaft A rotates at uniform speed of 2000 r.p.m., what is the maximum torque in B? **04**

(You can use: For maximum acceleration, $\cos 2\theta = \frac{2 \sin^2 \alpha}{2 - \sin^2 \alpha}$

and maximum torque = $\frac{W}{g} k^2 \times (acc)_{max}$

- (c) Describe in detail constructional features of the tube and tubeless tyres for automotive use. Discuss also their relative merits and demerits. **07**
- OR**
- Q.3**
- (a) State objectives of vehicle suspension. **03**
- (b) Derive expression for the basic condition for a perfect steering mechanism for perfect rolling of all wheels. **04**
- (c) Explain various resistances to motion of a vehicle in 600 words. **07**

- Q.4 (a)** Define following terms w.r.t to steering geometry: **03**
1. Castor angle
 2. Camber angle
 3. Toe-in
- (b)** Sketch constant mesh gear box **04**
- (c)** Simple Structural Surfaces representing a box van in torsion. The diagram, **07**
Figure 2, shows simple structural surfaces representing a van structure. The front and rear track t_f and t_r respectively may be slightly different and the rear axle load R'_r is usually smaller than R_f for a modern passenger car even when fully laden.
- SSS-2 (Front cross beam)
SSS-3 (Rear cross beam)
SSS-4 (Front panel)
SSS-5 (Rear door frame)
SSS-6 (Left hand side frame)
SSS-7 (Right hand side frame)
SSS-8 (Floor panel)
SSS-9 (Windscreen frame)
SSS-10 (Roof)

Derive mathematical formula (equation) to determine edge load Q_1 to Q_6 .

(Hint: Take torsion moment : $\frac{R_f}{2} t_f = \frac{R'_r}{2} t_r$)

The equilibrium of the SSS-2 and SSS-3 can be obtained by taking moments, and as the values of R_f and R'_r are known the values of P_2 and P_3 are obtained. Then apply momentum principle to Simple Structural Surfaces to determine edge forces. The centre cross beam SSS-1 has no loads applied in this case, but will be loaded in the bending case.)

OR

- Q.4 (a)** Name of components used in battery ignition system of automobile. **03**
- (b)** Express at least six advantages of independent suspension over the rigid axle type suspension. **04**
- (c)** Explain the fully floating axle with the help of a neat sketch. **07**
- Q.5 (a)** State principle and requirements of automotive brakes. **03**
- (b)** Construct table indicate main components of electrical system. **04**
(Hint: Prepare table of electrical system and heading of tables are 1. Starting system 2. Generating or charging system 3. Ignition system 4. Lighting system 5. Accessories)
- (c)** Consider the MacPherson strut given in Figure 3. By graphical approach **07**
determine (a) the suspension ratio R (the rate of change of vertical movement at D as a function of spring compression) and (b) the bump to scrub rate for the given position of the mechanism.
(Hint:
1. Drawing the suspension mechanism to scale and assume the chassis is fixed.
2. Start with considering link AB have an arbitrary angular velocity $\omega_{BA} = 1$ rad/s in a clockwise direction.)

OR

- Q.5

(a)

List of indicating light used in automobile.

03

(b)

Describe battery recharging method in 250 words.

04

1. Slow rate recharging method

2. Trickle recharging method

(c)

Define braking efficiency (braking system uses the available tyre-ground adhesion). Derive expression of braking efficiency for the case of front axle lock and rear axle lock case. Draw diagram brake efficiency as a function of tyre-ground adhesion coefficient.

07

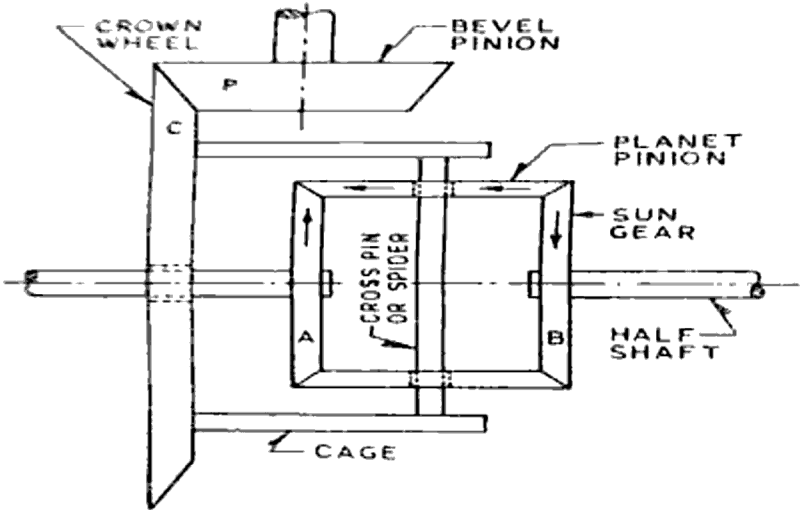


Fig. 1. Differential.

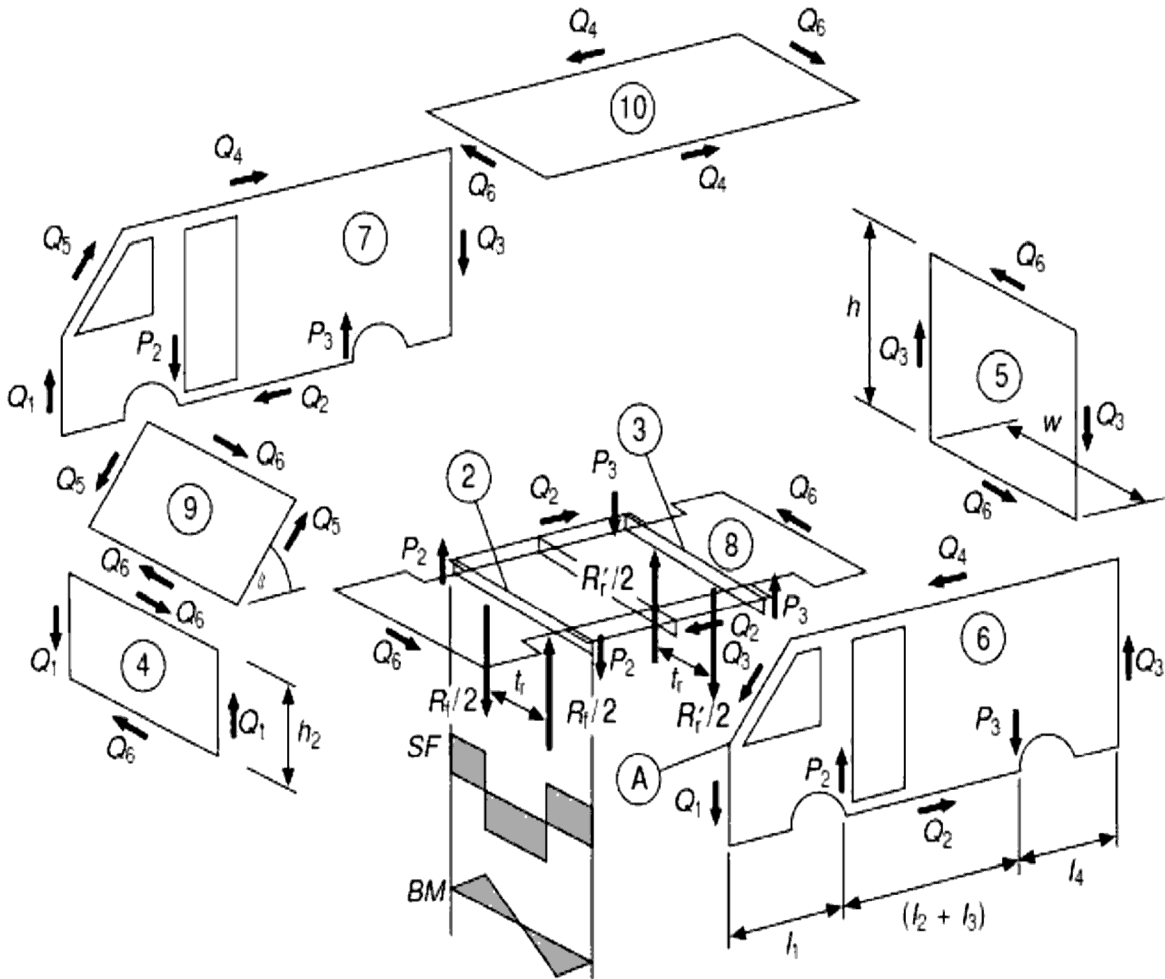


Fig. 2. Simple structural surfaces representing a van structure.

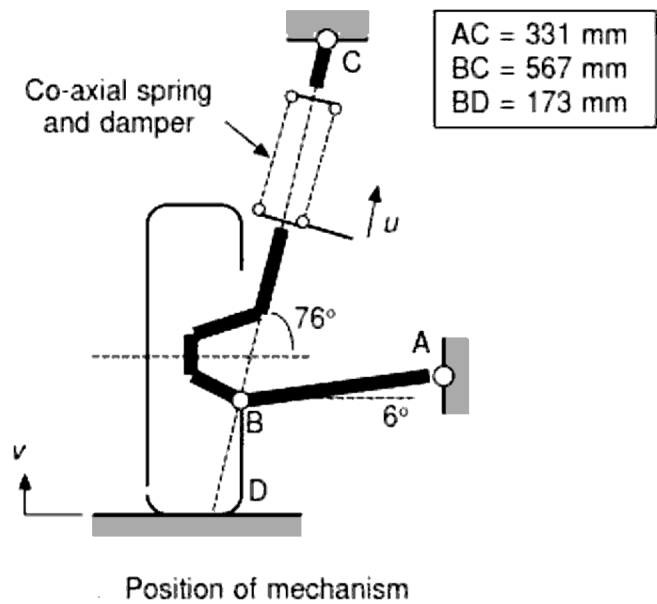


Fig. 3. MacPherson strut
