Printed Pages:02 **Sub Code:NAU603**

Paper Id: | **147230** | **Roll No.** | | | | | | | | | |

B TECH
(SEM-VI) THEORY EXAMINATION 2018-19
DESIGN OF AUTOMOTIVE COMPONENTS

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections.
   2. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** **2 x10 = 20**
   a. How is permeability considered to design a clutch?
   b. List out the factors to be consider for the selection of engineering materials?
   c. What is the difference between coupling andclutch?
   d. What is the difference between gear ratio and velocity ratio?
   e. How can we select the gear ratio for designing transmission?
   f. Which is better: a gear transmission or a gearless transmission?
   g. Why is rear wheel drive better than front wheel drive?
   h. What is the difference between shaft and axle?
   i. What are the potential failure modes for mechanical linkage steering?
   j. What is the difference between transmission ratio and final drive gear ratio?

SECTION B

2. **Attempt any *three* of the following:** **10 x 3 = 30**
a. Describe, with the help of a neat sketch, a centrifugal clutch and deduce an expression for the totalfrictional torque transmitted. How the shoes and springs are designed for such a clutch?
b. Sketch the arrangements of a six-speed gear box. The minimum and maximum speeds requiredare around 460 and 1400 rpm. Drove speed is 1440 rpm. Construct speed diagram of the gear boxand obtain various reduction ratios. Use standard output speeds and standard step ratio. Calculatenumber of teeth in each gear and verify whether the actual output speeds are within + 2% of standardspeeds.
c. A truck spring has 12 number of leaves two of which are full length leaves. Thespring supports are 1.10m apart and the central band is 90mm wide. The centralload is 6KN with permissible stress of 300 MPa. Determine thickness and width ofspring leaves. If ratio of total depth to width of the spring is 3. Also determine thedefection of the spring.
d. What are the required calculations for the Anti Ackermann Steering Mechanism?How does kingpin offset affect steering effort and what are the other effects of it?
e. 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 a 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/m^2. Calculate the diameter of the axle.

SECTION C

3. **Attempt any one part of the following:** **10 x 1= 10**
   (a) Why a positive clutch is used? Describe, with the help of a neat sketch, the working of roller and sprag type of clutches.
   (b) A centrifugal clutch is to be designed to transmit 15 kW at 900 r.p.m. Theshoes are four in number. The speed at which the engagement begins is 3/4th of the running speed.The inside radius of the pulley rim is 150 mm. The shoes are lined with Ferrodo for which thecoefficient of friction may be taken as 0.25. Determine: (i). mass of the shoes, and (ii). size of the shoes.

4. **Attempt any one part of the following:** **10 x 1 = 10**

(a) What is tractive force? How is it calculated? Why do we calculate tractive force? What is difference between tractive force and tractive effort?

(b) The maximum gear box ratio of an engine 75 mm bore, and 100 mm stroke is 4. The pitch diameter of the constantly meshing gear is 75% of the piston stroke. If the module is 4.25 mm, 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 910 kgf/cm^2. Draw the neat sketch of the three-speed gear layout.

5. **Attempt any one part of the following:** **10 x 1 = 10**

(a) Compare semi elliptical leaf spring & helical spring used in automotive suspensionsystem with respect to i) materials ii) strength iii) comfort.

(b) Design a spring for a balance to measure 0 to 1000 N over a scale of length80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turnsis 30. The modulus of rigidity is 85 kN/mm^2. Also calculate the maximum shear stress induced.

6. **Attempt any one part of the following:** **10 x 1 = 10**

(a) Assume a driver has a car that normally exhibits understeer (tractive forces neglected). Ifthis driver enters a turn too rapidly and applies the brakes, what happens to the handlingcharacteristics of the car? Assume the brakes do not lock up, and consider that weighttransfers to the front axle during braking.

(b) The Ford Ranger Super cab has a 10-ft wheelbase and rides on P245/75R16 tires (same onthe front and rear) that provide a cornering stiffness of 200 1b/^{0}. The truck weighs 3650 1band has a front/rear weight distribution of 55/45 (%).

(i) What is the understeer gradient for this truck?

(ii) What is the characteristic speed of the truck?

(iii) Suppose the owner decides to put a half ton (1000 lb) of wood in the back of the truck. Assuming that all of the weight is applied to the rear axle and that the truck has the original radial tires on the rear, what is the critical speed for the truck? Neglect tractive forces in your analysis. Where should the center of gravity of the wood be located (distance forward of the rear axle) to ensure the truck does not exhibit oversteer?

7. **Attempt any one part of the following:** **10 x 1 = 10**

(a) What are the functions of the principle components in a vehicle driveline and the final drive?Name thevarious types of rear axles and explain any one typewith a neat sketch.

(b) The thrust of propeller shaft ina marine engine is taken up by a number of collarsintegral with the shaft which is 300 mm is diameter.The thrust on the shaft is 200 kN and the speed is75 r.p.m. Taking µ constant and equal to 0.05 andassuming the bearing pressure as uniform and equal to 0.3 N/mm^2, find:
(i) Number of collars required,
(ii) Power lost in friction, and
(iii) Heat generated atthe bearing in kJ/min.