Design of gear for given requirements

Car Model Selected: - Maruti Suzuki Swift VXI

Details on Maruti Suzuki Swift VXI

1. Capacity: - 1197cc
2. Max Power: - 61kw @6000rpm
3. Max Torque: - 113Nm @4200rpm
4. No of Cylinders: - 4
5. Emission Type: - BS6

Assumptions: -

1. PCD (Pitch Circle Diameter) = m*z =180 mm.
2. m = module (Selected as 10 mm)
3. z = No of teeth (Selected as 18)

Power @ max torque (P)= $2\pi NT/60$

(P)= 2*3.14*4200*113/60

(P)= 49,674.8 watt.

Torque = Force*(PCD/2)

Force (F)= torque/ (PCD/2)

(F)= 113000/ (180/2)

(F) = 1255.556 N.

Using Lewis Equation,

$F= \pi*m*b*y*\sigma$

Where,

1. b = face width (8m <b< 12m According to Design of Machine Elements by V B Bhandari)
2. y= Lewis tooth form factor = 0.308. (for pressure angle 20 degree full depth involute system and z=18)
3. m= Module= 10.

σ= allowable stress

1255.556= 3.14*10*100*0.308*σ (face with b is taken as 100mm)

σ = 1.29824 N/sq.mm.

Now σ < Sut/3 (Taken from Design of machine elements by V B Bhandari)

(Ultimate Tensile Strength of composite material)/3 > σ.

From the data on Maximum Tensile strength of composite materials:-

1. Maximum Tensile strength of Al-SiC at 15% SiC= 94.21 N/sq.mm.
2. Maximum Tensile strength of PC-ABS at (60/40) = 35 N/sq.mm.
3. Maximum Tensile strength of CFRP at 50% reinforcement= 52 N/sq.mm.

Checking for allowable stress for composite materials:-

1. Allowable stress for Al-SiC at 15 %SiC=Max Tensile strength/3

   =94.21/3=31.4034 N/sq.mm > 1.29824 N/sq.mm.

   So, the design is safe.

2. Allowable stress for PC-ABS at (60/40)=Max Tensile strength/3

   =35/3=11.667 N/sq.mm > 1.29824 N/sq.mm.

   So, the design is safe.

1. Allowable stress for CFRP at 50% reinforcement=Max Tensile strength/3

   =52/3=17.334 N/sq.mm > 1.29824 N/sq.mm.

   So, the design is safe.