IV SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2024

SUBJECT: AUTOMOTIVE COMPONENT DESIGN [AAE -2226]

REVISED CREDIT SYSTEM

(03/05/2024)

Time: 3 Hours MAX. MARKS: 50

Q No	Question	Marks	CO attained	BT level
1A	State any 6 criteria that a machine element should satisfy as the basic requirement from machine design perspective	**2**	**1**	**2**
1B	Explain the phenomenon of fatigue failure, also explain how the failure is different from static load failure	**3**	**1**	**2**
1C	A solid circular shaft of diameter 45 mm is loaded by bending moment 650 Nm, torque 900 Nm and an axial tensile force of 30 kN. The shaft material is ductile with yield strength of 280 MPa. Determine the factor of safety according to Tresca's and Von Mises' theory of failure	**5**	**1**	**3**
2A	A close coiled helical spring is subjected to a load of 800 N and deflects by 40 mm. The diameter of each coil is 10 times that of wire and the maximum shear stress is not to exceed 350 MPa. Take G = 84 GPa. Design the spring, by calculating the wire diameter, Inner & Outer diameters, no. of turns, and the total length of the spring	**4**	**2**	**3**
2B	From the previous question data, calculate the pitch and stiffness of the spring	**2**	**2**	**3**
2C	Design the truck spring that has 12 number of leaves, two of which are full length leaves. The spring supports are 1 m apart and the central band is 70 mm wide. The central load is to be 6 kN with a permissible stress of 200 MPa. Determine the thickness, width and deflection of the spring leaves when i) the leaves are not pre-stressed ii) the leaves are pre-stressed, Consider the ratio of total depth to width of the spring as 3 for both the cases, $E = 2 \times 10^5$ N/mm^2	**4**	**2**	**3**

<table>
<tr><td>3A</td><td>A pair of spur gears has to transmit 20 kW from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Number of teeth on pinion is 31 with 20^o full depth involute tooth form. The material for pinion is steel SAE 1040 untreated with allowable static stress 206.81 MPa (BHN = 150) and the material for the gear is cast Steel 0.20 % C untreated with allowable static stress 137.34 MPa (BHN = 180). Determine the module, face width of the gear pair. Take service factor as 1.5, Consider E = 2.1×10^5 N/mm^2</td><td>5</td><td>3</td><td>3</td></tr>
<tr><td>3B</td><td>For the data from the previous question, calculate the dynamic load, state the class of gear chosen based on the error</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>3C</td><td>From the data from the previous question, calculate the limiting wear load on the tooth</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>4A</td><td>Select a suitable ball bearing which is to operate at 1500 rpm, and is acted upon by 8000 N radial load and 5000 N thrust load. The inner ring rotates, the load is steady and the service is continuous. The shaft diameter, from strength consideration, is 45 mm, and the life expectancy is 500 hrs.
<table>
<tr><td>Bearing No.</td><td>6209</td><td>6309</td><td>6409</td></tr>
<tr><td>Bore (mm)</td><td>45</td><td>45</td><td>45</td></tr>
<tr><td>C_o (N)</td><td>17750</td><td>29225</td><td>45600</td></tr>
<tr><td>C (N)</td><td>24910</td><td>40700</td><td>57400</td></tr>
</table></td><td>4</td><td>4</td><td>3</td></tr>
<tr><td>4B</td><td>From the previous question, with data from the table, select a suitable bearing which satisfies the design consideration</td><td>3</td><td>4</td><td>3</td></tr>
<tr><td>4C</td><td>State the five distinct forms of lubrication and explain any one</td><td>3</td><td>4</td><td>2</td></tr>
<tr><td>5A</td><td>Select & Design a roller chain for a bucket elevator to be driven by a gear motor. The gear motor has 6 kW and runs at 120 rpm. The speed of the bucket elevator is 60 rpm. The elevator operates 10 hours per day with mild shock. Consider a factor of safety as 7.73 for calculation of working load. Also calculate no. of strands</td><td>4</td><td>5</td><td>3</td></tr>
<tr><td>5B</td><td>For the data in previous question calculate the chain length in pitches, actual centre distance and pitch diameters of the sprockets</td><td>3</td><td>5</td><td>3</td></tr>
<tr><td>5C</td><td>Explain the phenomenon of creep in a belt drive with the necessary diagram</td><td>3</td><td>5</td><td>2</td></tr>
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