Govt. Engineering College Ajmer
First Mid-Term Test
VI Semester Mechanical (Session 2016-17)
Sub: Design of Machine Elements - II

Time: 1 Hour **Max. Marks: 20**

1. A solid circular shaft 15 mm in diameter is subjected to torsional shear stress that varies from 0 to 35 N/mm^2 and at the same time is subjected to an axial stress that varies from -15 to 30 N/mm^2. The frequency of variation of these stresses is equal to the shaft speed. The shaft is made of steel FeE (S_u=540 MPa and S_y=400 MPa) and corrected endurance limit in axial loading is 200 MPa and in torsional loading is 160 MPa. Determine factor of safety
2. Derive Lewis equation for beam strength of a Spur gear. Also state its assumptions.
3. A helical cast steel gear with 30° helix angle has to transmit 35 kW at 2000 r.p.m. If the gear has 25 teeth, find the necessary module, pitch diameters and face width for 20° full depth involute teeth. The static stress for cast steel may be taken as 100 MPa. The face width may be taken as 3 times the normal pitch. The tooth form factor is given by the expression $y' = 0.154 – 0.912/T_E$, where T_E represents the equivalent number of teeth. The velocity factor is given by $C_v = 6/6 + v$ where v is the peripheral speed of the gear in m/s.
4. What is the need for modifying Endurance limit? List various Endurance limit modifying factors.

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Time: 2 Hours **Max. Marks: 20**

1. A helical valve spring is to be designed for an operating load range of approximately 90 to 135 N. The deflection for the load range is 7.5 mm. Assume a spring index of 10, permissible shear stress of 480 MPa and modulus of rigidity of 80 GPa. Design the spring.
2. A single row deep groove ball bearing is subjected to a radial load of 8 kN and a thrust load of 3 kN. The shaft rotates at 1200 rpm and expected life of bearing is 20000 hours. The minimum acceptable diameter of shaft is 75 mm. Select a suitable ball bearing for this application. Assume a service factor of 1.0.
3. Following data is given for a full hydrodynamic bearing: Radial load = 25 kN, journal speed = 900 rpm, unit bearing pressure = 2.5 MPa, L/D = 1.0, viscosity of lubricant = 2.5 cp. Calculate: (a) minimum film thickness, (b) amount of artificial cooling required and (c) requirement of oil flow.
4. It is required to select a V-belt drive to connect a 20 kW, 1440 rpm motor to a compressor running at 480 rpm for 15 hours per day. Space is available for a centre distance of approximately 1.2 meters. Determine: (a) belt specifications (b) no. of belts (c) corrected centre distance and (d) pulley diameters.
5. A flat belt, 8 mm thick and 100 mm wide transmits power between two pulleys running at 1600 m/min. The mass of belt is 0.9 kg/m length. The angle of lap on the smaller pulley is 165° and coefficient of friction between belt and pulley is 0.3. If the maximum permissible stress in the belt is 2 MPa, find (a) maximum power transmitted and (b) initial tension in the belt.