

Technical Engineering College – Baghdad
Final Examination – 2017/2018

Dept: Mechatronics Engineering Technique

Class: 4th Year

Date: \ / 6 / 2018



Subject: Machine Design

Time: 3 Hours

Examiner: Dr. Khudhayer J. Jadee

Notes: Answer Five Questions Only. This is an open book exam. Figures to the right indicate full marks.

- Q1** A rectangular sunk key of 24x12x130mm dimension is required to transmit 140N.m torque from a 90mm diameter solid shaft. Determine whether the length is sufficient or not if the permissible shear stress and crushing stress intensities limited to 60 and 130 MPa respectively. **20**
- Q2** A journal bearing in a generator has a diameter to length ratio as 1 and it is to operate at a speed of 600 rpm and carry a load of 6kN. The bearing pressure is 3MPa. The radial clearance has been specified as 0.042mm. If SAE 30 oil at an inlet temperature of 50°C with absolute viscosity 0.02kg/m.s is used; determine:
a) The optimum size of the bearing.
b) The heat generated
c) The heat dissipated
Assume ambient temp.=16°C, Heat dissipation coefficient =1200W/m²/°C **20**
- Q3** A transmission shaft is subjected to fluctuating torsion that varies from -100N.m to 400N.m. Let the size factor=0.83, surface finish factor=0.61 and factor of safety=2. Determine the required diameter of shaft. Shaft material is a steel ($\sigma_y=370\text{MPa}$, $\sigma_u=720\text{MPa}$). Take the endurance in shear limit as 0.22 of the ultimate strength and $\tau_y=0.5\sigma_y$. **20**
- Q4** A wedge belt drive is required to transmit 19 kW from an electric motor running at 1500 rpm, to a uniformly loaded conveyor running at 428 rpm. The desired centre distance is 1.5 m and expected use is 15 hours a day. Select a suitable belt, or belts, and determine the pulley diameters. **20**
- Q5** A helical valve spring (under cyclic loading) is to be designed for an operating load range of 100 N to 145 N. The deflection of the spring for this load range is 8.2 mm. Assuming a spring index of 10, a permissible shear stress of 475 N/mm² and a modulus of rigidity of 85GPa for the material; determine the dimensions of the spring. **20**
- Q6** An Acme thread screw is used to lift a 9900 N load. The mean collar diameter is 2 in. Find the torque to lift and to lower the load using a ball-bearing thrust washer. What are the efficiencies? Is it self-locking? (Assumptions: radial thread angle $\alpha=14.5^\circ$, $\mu=0.15$, $\mu_c=0.02$, the thread per pitch (N)=5 and the pitch diameter (dp)=1.3 in). **20**