BE/ VII/ 5854/ Machine Design -II /28/11/15

QP Code : 5854

(REVISED COURSE)

Max.Marks: 80
Duration : 3 hrs.

NB: 1. Question No. 1 is compulsory.
2. Solve any three questions from remaining questions.
3. Assume suitable data with proper justification if required.
4. Use of standard design data book like PSG, Mahadevan is permitted.

Q.1. Answer any four of the following

(a) Explain various types of gear tooth failures.

(b) Explain static and dynamic seals with examples.

(c)Define pressure angle and explain its significance in the design of cam.

(d) Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearing

(e) What are design requirements of friction clutches and how are they selected?

Q.2. A pair of helical gears is used to transmit power from a electric motor rated at25 kW, 960 rpm.The motor is coupled to the pinion shaft and the output shaft isrequired to rotate at 250 rpmand it is parallel to pinion shaft. The helix angle is 17 deg. and the gears are 20^0 pressure angle stub teeth. (20

(i) Selecting suitable material, determine number of teeth, module, width etc.

(ii) Check the gear for dynamic load using Buckingham's analysis for average gear.

(iii) Design the pinion and gear blanks and draw sketches with dimensions

Q.3. (a) A worm reduction unit is required to transmit 15 kW power from an electric motor operating at 1440 rpm, the output speed is 80 rpm and the load is with mild shock, duty normal. Selecting suitable material and stresses, design worm and worm wheel for strength and wear. Do not check for heat dissipation capacity. (10)

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(b) A deep groove ball bearing having SKF No. 6314 is subjected to load cycles as below which is repeated. (10)

Phase	Radial Load (KN)	N (rpm)	%age
I	3.5	300	15%
II	4.5	380	40%
III	7.5	270	45%

Under each phase the loads average with high shock. Inner race under rotation and operating temperature 135°C. Determine expected life of the bearing in hours with probability of survival being 93%.

Q.4

(a) The radial load on a 180° hydrodynamically lubricated journal bearing is 12 KN. Journal speed is 960 rpm. Assuming suitable fit, design the bearing for average clearance. Considering heat generated is dissipated from the bearing surface area, which is 25L.D. The bearing, which is placed in an oil bath, is cooled by moving air. The pressure is limited to 1.5 N/mm^2. Find oil flow rate, coefficient of friction, power loss and temperature rise. (10)

(b) Design cross section of the flat belt drive to run the compressor having reduction ratio 3.15. Input speed is 960 rpm and power to be transmitted 15 kW. Compressor runs to 10-12 hours per day. Expected life of the belt is $1\frac{1}{2}$ years. (10)

Q.5 A rotary plate cam and central translatory follower has following motion: (20)

Outward motion of 25 mm in 100 degrees of cam rotation with parabolic motion, return to normal position with SHM in 90° rotation of cam and dwell for the remaining period. The mass of the follower is 1.5 kg and the cam shaft rotates at 600 rpm. Maximum pressure angle is 25° during forward stroke. The external force is 300 N during forward stroke and 50N during return stroke.

i. Design the cam, the roller follower along with its pin and spring.

ii. Calculate the maximum cam shaft torque.

Q.6. (a) 7.5 kW power is transmitted by a multiplate clutch at 960 rpm. The plates run in oil and coefficient of friction is 0.07. Axial intensity of pressure is not to exceed 0.15 N/mm^2. Due to space limitations, external radius is restricted to 125 mm. (12)

i) Determine number of plates and inner radius.

ii) Design input shaft and output splined shaft.

iii) If the clutches use 6 springs, decide dimensional details of the spring.

(b) A chain drive is required to transmit 7.5 kW power from a shaft rotating at 960 rpm with a reduction ratio of 3.5 approximately. The drive operates for 14-16 hours per day with mild shock and is provided with drop lubrication system. Determine actual factor of safety for designed chain. (08)

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