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UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M.Tech/ Rotating Equipments | **Semester – I**
Subject (Course): Advanced Machine Design | **Max. Marks : 100**
Course Code : MERE 7003 | **Duration : 3 Hrs**
No. of page/s: 02

Note: Attempt all the questions. There is internal choice in section B and section C. Assume suitable data if missing. Use of data handbook is permitted.

Section 'A' (4x5=20 marks)

1. Explain the importance of bearing modulus in designing the journal bearing.
2. Discuss the various design considerations for rolling contact bearing.
3. Enlist the assumptions made in deriving the basic 'Lewis Equation' for the strength of gears.
4. Explain why the bolt in flange coupling should be made weaker than the other components of couplings.

Section 'B' (4x15=60 marks)

5. Two steel bevel gears, both having a Brinell hardness of 250, connect shaft at 90 degree. The teeth are 20^0 full depth and the module is 5 mm. The number of teeth on the pinion and gears are 30 and 48.The face width is 38 mm. Determine the wear load.
6. Select a single row deep groove ball bearing for a radial load of 7500 N and an axial load of 8500 N, operating at a speed of 1200 rpm, for an average life of 5 years at 8 hours per day. Assume uniform and steady load. Take the bore diameter as 120 mm.
7. Design a bearing and journal to support a load of 4500 N running at 600 rpm using a hardened steel journal and a bronze backed Babbitt bearing. The bearing is lubricated by oil rings. Take room temperature as 21^0C and the oil temperature as $80\ ^0$C.

8. Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used :

Shear stress for shaft, bolt and key material = 40 MPa

Crushing stress for bolt and key = 80 MPa

Shear stress for cast iron = 8 MPa

OR

Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 rpm. The overall torque is 20 percent more than mean torque. The material properties are as follows:

(a) The allowable shear and crushing stress for shaft and key materials are 40 MPa and 80 MPa respectively.

(b) The allowable shear stress for cast iron is 15 MPa.

(c) The allowable bearing pressure for rubber bush is 0.8 N/mm2.

(d) The material of the pin is same as that of shaft and key.

Section 'C' (1x20=20 marks)

9. A compressor running at 400 rev/min, is driven by a 125 kW, 1440 rev/min motor through a pair of 20 degree full depth helical gears having helix angle 22 degree. The central distance is approximately 300 mm. The motor pinion is made off forged steel and the driven gear is to be of cast steel. Assume medium shock conditions. Design the gear pair.

OR

A 18 kW and 1200 rpm motor drives a compressor at 400 rpm through a pair of spur gears having 20° stub teeth. The centre to centre distance between the shafts is 400 mm. The motor pinion is made of forged steel having an ultimate stress as 440 MPa, while the gear is made of cast steel having ultimate stress as 280 MPa. FOS may be taken as 1.5 for gear and pinion. Assuming that the drive operates 8 to 10 hours per day under light shock conditions, Design the spur gear.