

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Design of Machine Elements (ADEG 225)

Semester: VI

Program: B. Tech - Mechatronics

Time: 03 hrs.

Max. Marks: 100

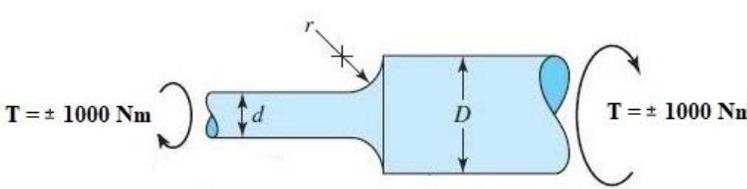
Instructions:

1. Design Data Hand Book by K. Mahadevan, K. Balaveera Reddy is allowed.
2. ASSUME ANY DATA WHICH IS NOT GIVEN
3. All questions are compulsory
4. Total no. of Pages - 03

SECTION A

S. No.	Statement of question	Marks	CO
Q 1	Find the numbers of R10 series from 10 to 20.	5	CO1
Q 2	Explain the design of nut of a screw jack with diagram.	5	CO3
Q 3	Discuss stress concentration and methods to reduce the stress concentration.	5	CO2

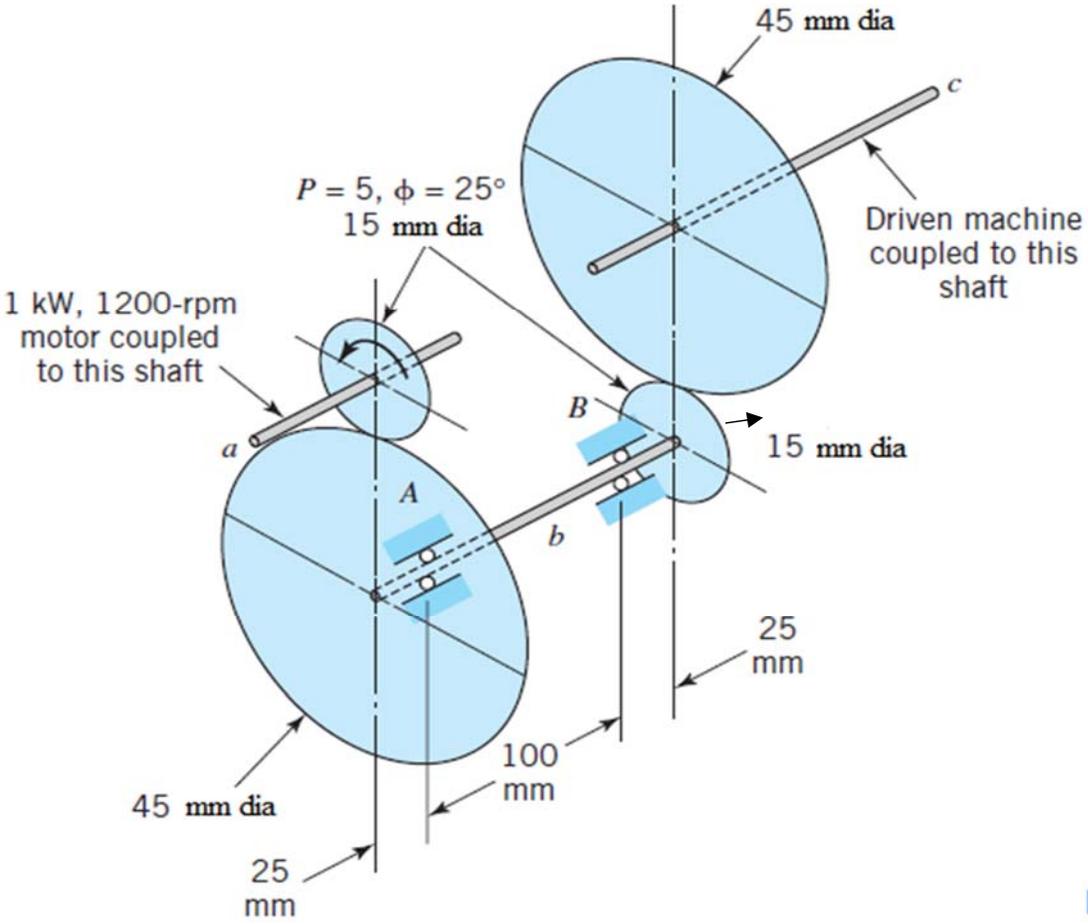
SECTION B

Q 4	Select a suitable bearing (with explanation of selection) for an axial flow compressor having a radial load of 2500 N and an axial thrust of 1500 N. Shaft is running at 720 rpm and the desired life is 20000 hours. OR Design a journal bearing to be used in a centrifugal pump having diameter of 0.12 m running at 1200 rpm. Consider the radial load on bearing as 22.70 KN. Assume appropriate material.	14	CO5
Q 5	A machined shaft is subjected to a completely reversed load of 1000 Nm as shown in the figure below. It is required that the shaft have a shoulder, with $D/d = 1.33$ and $r/d = 0.05$ (as shown in figure below). What diameter "d" is required for infinite fatigue life considering a factor of safety of 2 and material of the shaft as 45C8? Take size factor as 0.8, reliability of 90 % and notch sensitivity of 0.8. 	12	CO2

Q 6	Design a rigid flange coupling for a steel shaft transmitting 15 KW at 200 rpm. Assume appropriate material for various parts.	14	CO4
-----	--	----	-----

SECTION-C

Q 7	<p>Below figure shows a two-stage gear reducer. Identical pairs of gears are used. (This enables input shaft <i>a</i> and output shaft <i>c</i> to be colinear, which facilitates machining of the housing.) Shaft <i>b</i>, called the countershaft, turns freely in bearings <i>A</i> and <i>B</i>, except for the gear-tooth forces. Design the countershaft i.e. <i>b</i> by taking appropriate assumptions as per ASME code.</p>		
-----	---	--	--

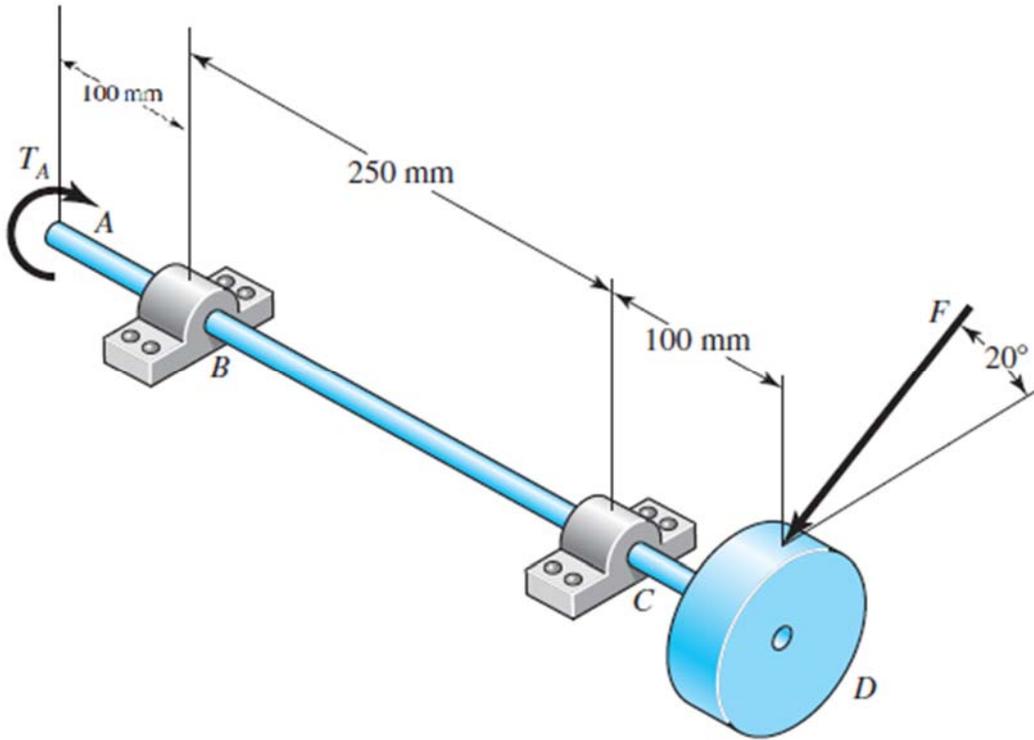


25 CO4

OR

The rotating solid steel shaft is simply supported by bearings at points B and C and is driven by a gear (not shown) which meshes with the spur gear at D, which has a 150-mm pitch diameter. The force *F* from the drive gear acts at a pressure angle of 20°. The shaft transmits a torque to point A of $T_A = 340 \text{ Nm}$. Using a factor of safety of

2.5, determine the minimum allowable diameter of the shaft. Consider appropriate material of the shaft.



Q 8 In a reduction unit for a centrifugal pump, the pinion shaft is connected to a standard 23 KW of motor. The motor has no load speed of 1200 rpm. If the gear ratio is 2, design the pair of spur gear by taking appropriate assumptions. Design can be done by assuming either pitch line velocity or fixing the center distance.

20

CO4