ME 308 MACHINE ELEMENTS II

Second Project

## Gear Design and Bearing Selection

Surname / Name: **Due Date:**

In a factory, a conveyor is used to transfer bolts from workshop to assembly area. To operate this conveyor, a gearbox is needed. So, you have to design a gearbox for this conveyor based on given datas:

1) Design all gears used in this system (spur, helical and bevel gears). Specify all parameters such as module, teeth number, face width, contact ratio (axial, transverse, total), radial clearance, whole depth, etc. for each gear pair separately.
2) Select rolling contact bearings for points A, B, C, D, E, F.
3) **(Additional 10 points)** Specify minimum dimensions for gear box (length and depth) in the light of engineering calculations for gears, bearings and gaps between them.

All dimensions are in mm.

Res. Asst. M. Ali AKELOĞLU
Res. Asst. M. Furkan KALKAN
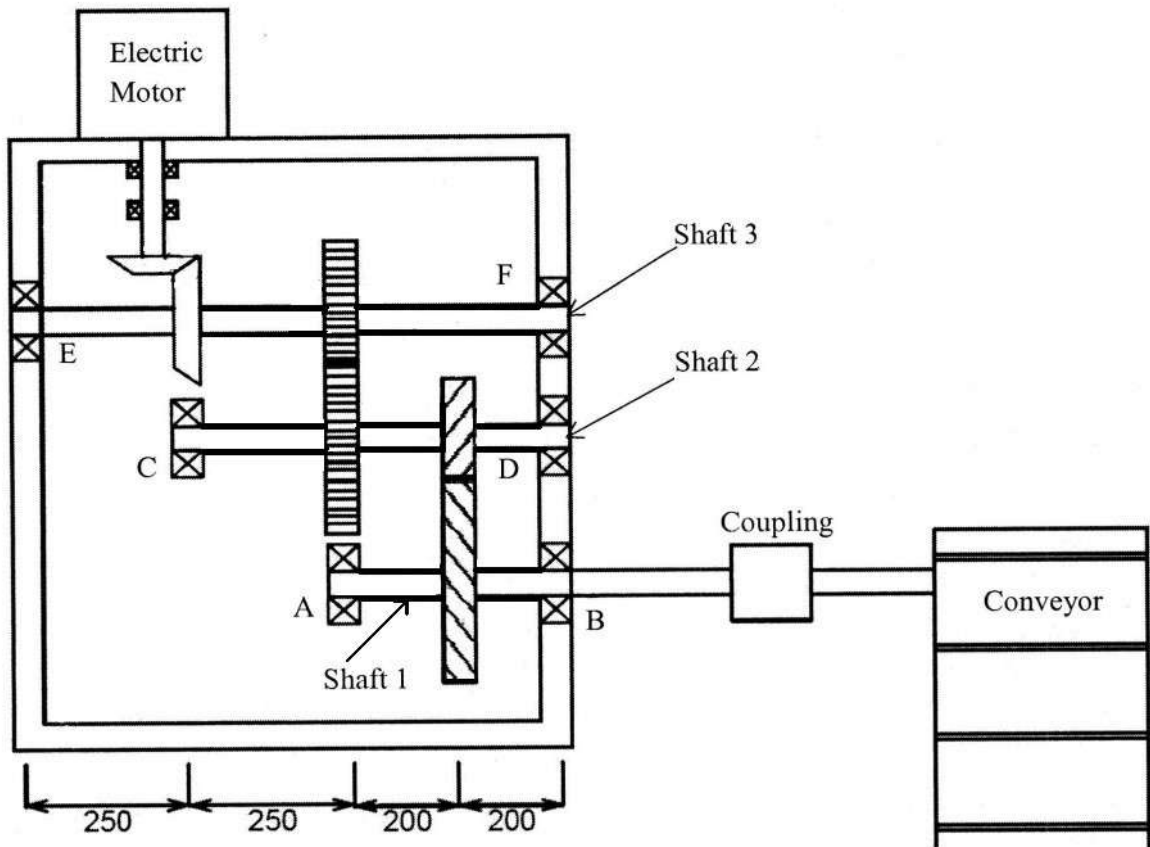
DATAS			
1)	Diameter of Conveyor drum	(cm)	20 / 25 / 30
2)	Electric Motor Power	(kW)	4 / 5 / 6
3)	Rotational speed of electric motor	(rpm)	1000 /1200 / 1500
4)	Linear speed of conveyor	(m/sec)	0.12 / 0.15 / 0.20
5)	Gear efficiency for spur gears	(%)	94/ 96 / 99
6)	Gear efficiency for helical gears	(%)	94/ 96 / 99
7)	Gear efficiency for bevel gears	(%)	94/ 96 / 99
8)	Gear efficiency for electric motor	(%)	85 / 90 / 95
9)	Helix angle for helical gears		15 / 20 / 25
10)	Factor of safety		2.0/ 2.5/ 3.0
11)	Materials of the gears		080M40 HR / 080M40 CD /080M40 H&T 080M50 HR / 080M50 CD /080M50 H&T
12)	Reliability of the gears	(%)	90 / 95 / 99 / 99.9
13)	Min. required life for bearings	(khrs)	20 / 25 / 30
14)	Surface hardness of spur gear sets	(HRC)	33 / 38 / 43
15)	Surface hardness of helical gear sets(HRC)		33 / 38 / 43
16)	Surface hardness of bevel gear sets	(HRC)	33 / 38 / 43

Shaft diameter 1 (mm) : $30 \leq d_1 \leq 40$

Shaft diameter 2 (mm) : $25 \leq d_2 \leq 35$

Shaft diameter 3 (mm) : $20 \leq d_3 \leq 30$

Life of gears   (cycles) : 10^8

IMPORTANT NOTES:

- Pressure angle for all gears is $20°$.
- Shaft diameters at both ends are same.
- For all calculations, use formulas Shigley's first edition. If necessary use another textbook but provide corresponding pages and formulas in your report.
- You can make any logical assumptions if you need.
- Project papers must be submitted with your report.
- If you need to any additional catalogue, you can use it, but you must submit it with your report.

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3D Example Representation:

Conveyor drum
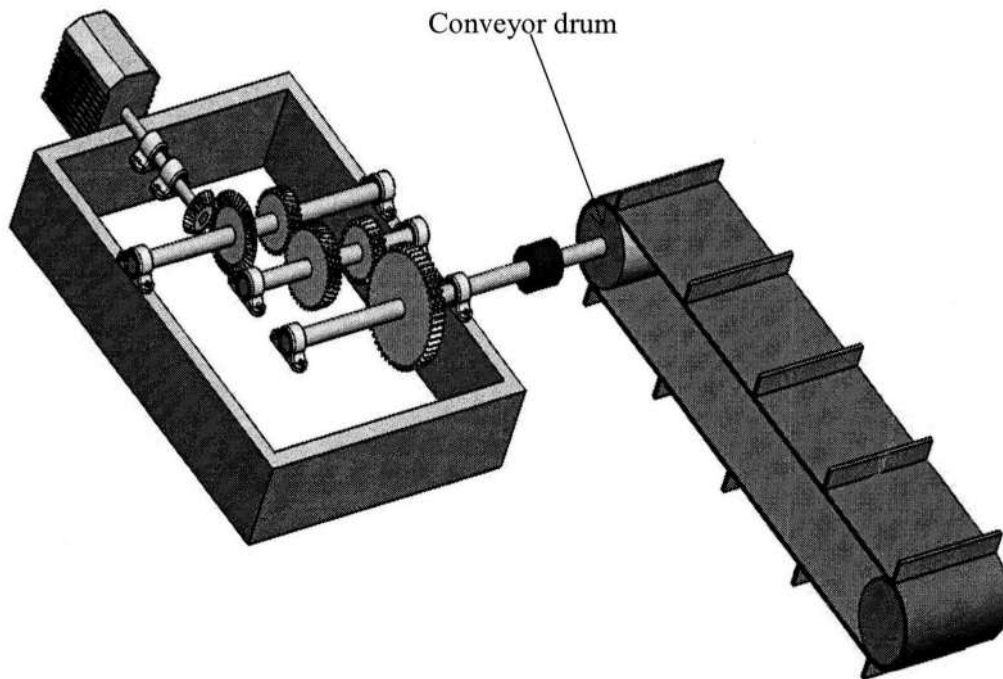
TO PREPARE THIS PROJECT:

- The reports should consist of the following parts:
  Introduction: should include why such a project is important and its possible areas of application.
  Design calculations: should include all the calculations required for the design. Your any assumptions must be in table but your final solution must be clearly visible. Final results should be placed in boxes.
  Discussion and conclusion: discuss methods of the analysis, design technique used, results, possible improvements, shortcomings, etc. and derive a conclusion.
- Mark the datas to your project paper and do not **FORGET** to put this project paper in your report.
- Projects must be given in a file. Be sure that the pages are numbered in the order of calculation.
- You can use any calculation program and tabulate your results in order to shorten assumption procedure. But your final solutions must be clearly visible.
- Use only standard A4 size white paper. You can use pencil. If your handwriting is not understandable, this is not responsible for me in grading process. Your handwriting must be clear.
- Copied reports will be disregarded and graded as <u>zero</u>.
- Projects should be submitted until deadline.
- Grading for the project will be based on the degree of completeness, degree of correctness of the calculations, and the presentation of the text.

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