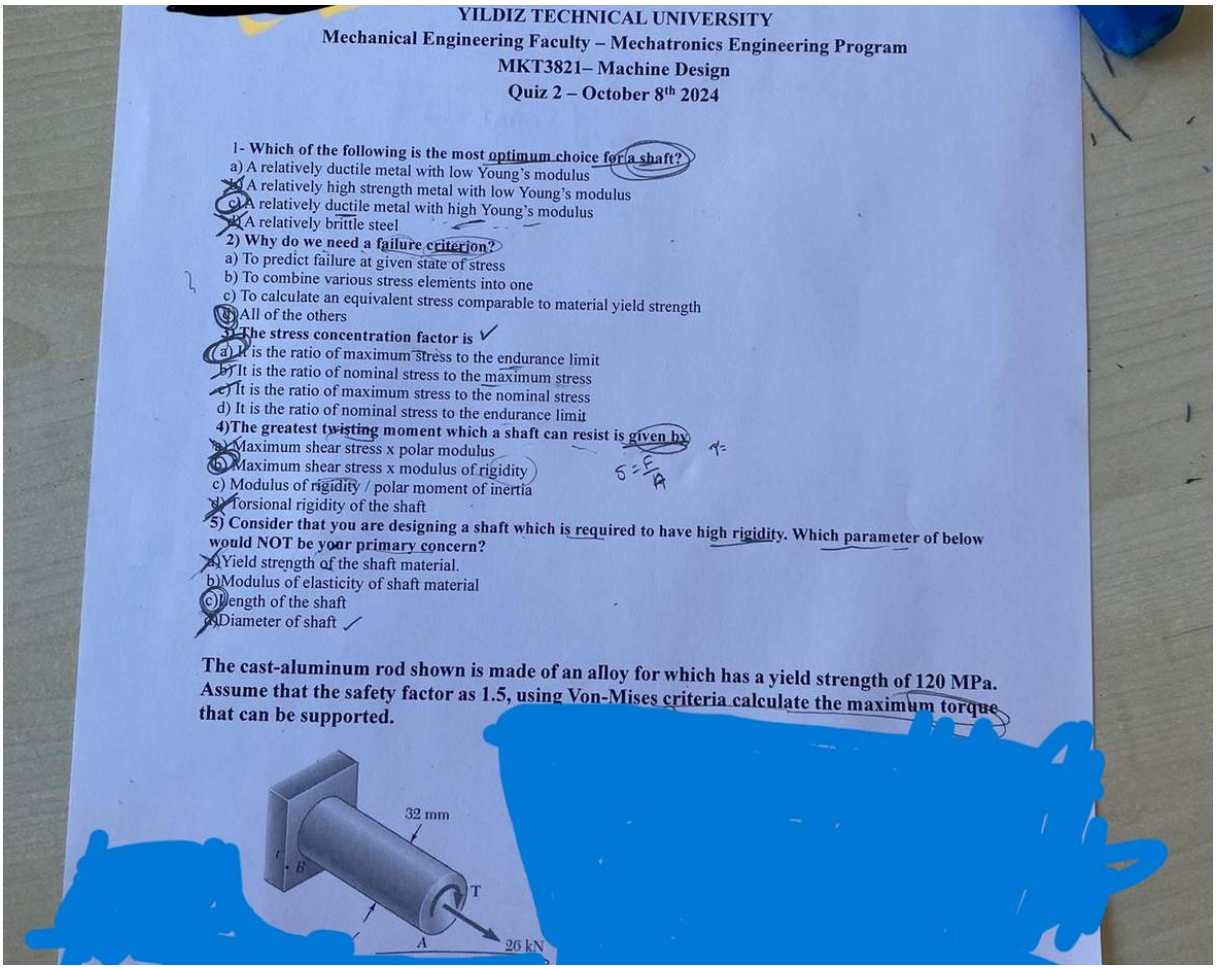
# 2024 -MAKİNE ELEMANLARI QUİZ SORULARI

## Quiz-2



YILDIZ TECHNICAL UNIVERSITY
Mechanical Engineering Faculty – Mechatronics Engineering Program
MKT3821– Machine Design
Quiz 2 – October 8th 2024

1- Which of the following is the most optimum choice for a shaft?
a) A relatively ductile metal with low Young's modulus
b) A relatively high strength metal with low Young's modulus
c) A relatively ductile metal with high Young's modulus
d) A relatively brittle steel

2) Why do we need a failure criterion?
a) To predict failure at given state of stress
b) To combine various stress elements into one
c) To calculate an equivalent stress comparable to material yield strength
d) All of the others

3) The stress concentration factor is
a) It is the ratio of maximum stress to the endurance limit
b) It is the ratio of nominal stress to the maximum stress
c) It is the ratio of maximum stress to the nominal stress
d) It is the ratio of nominal stress to the endurance limit

4) The greatest twisting moment which a shaft can resist is given by
a) Maximum shear stress x polar modulus
b) Maximum shear stress x modulus of rigidity
c) Modulus of rigidity / polar moment of inertia
d) Torsional rigidity of the shaft

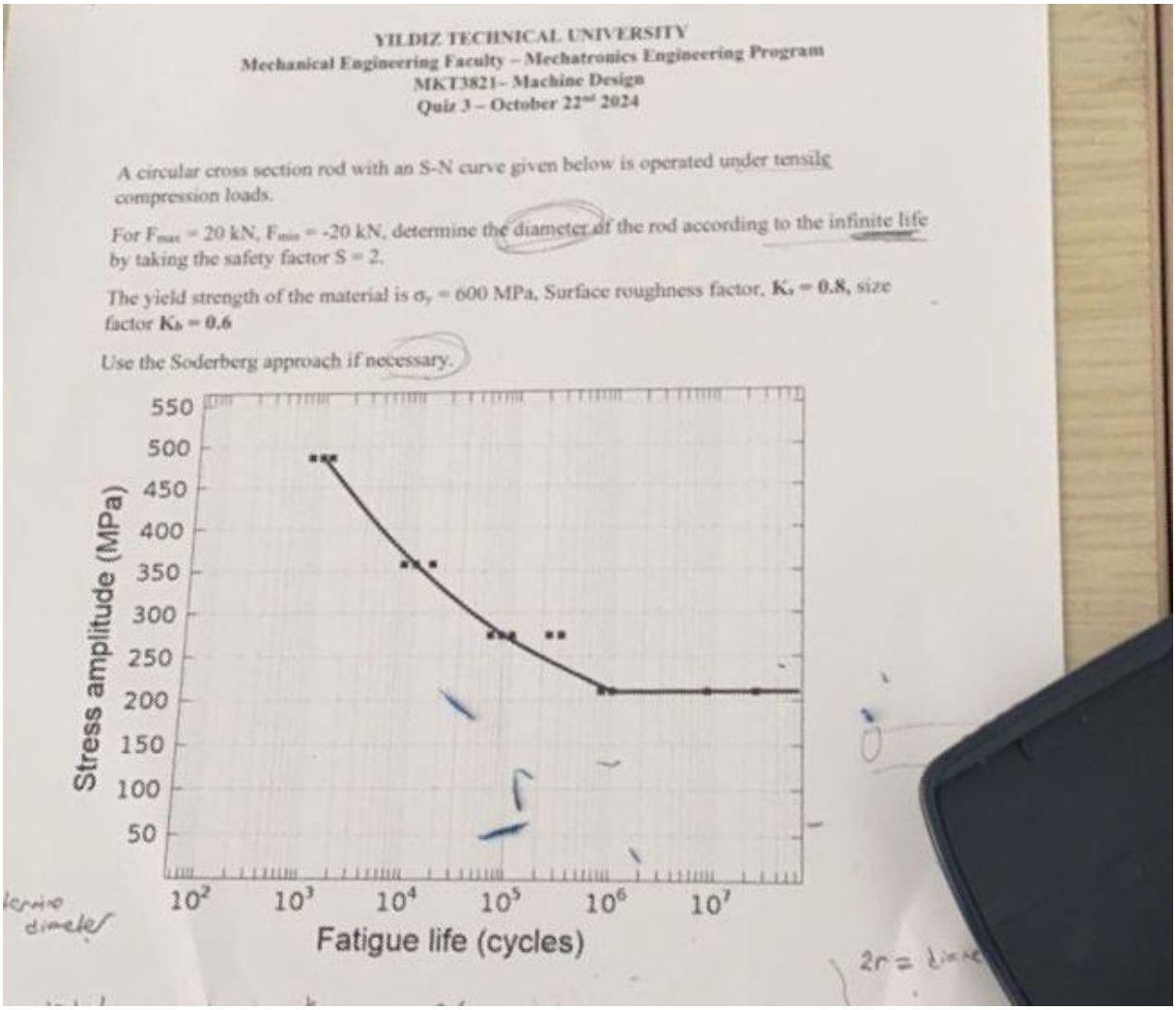
5) Consider that you are designing a shaft which is required to have high rigidity. Which parameter of below would NOT be your primary concern?
a) Yield strength of the shaft material.
b) Modulus of elasticity of shaft material
c) Length of the shaft
d) Diameter of shaft

The cast-aluminum rod shown is made of an alloy for which has a yield strength of 120 MPa. Assume that the safety factor as 1.5, using Von-Mises criteria calculate the maximum torque that can be supported.




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# Quiz-3



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Quiz 3 – October 22nd 2024

A circular cross section rod with an S-N curve given below is operated under tensile compression loads.

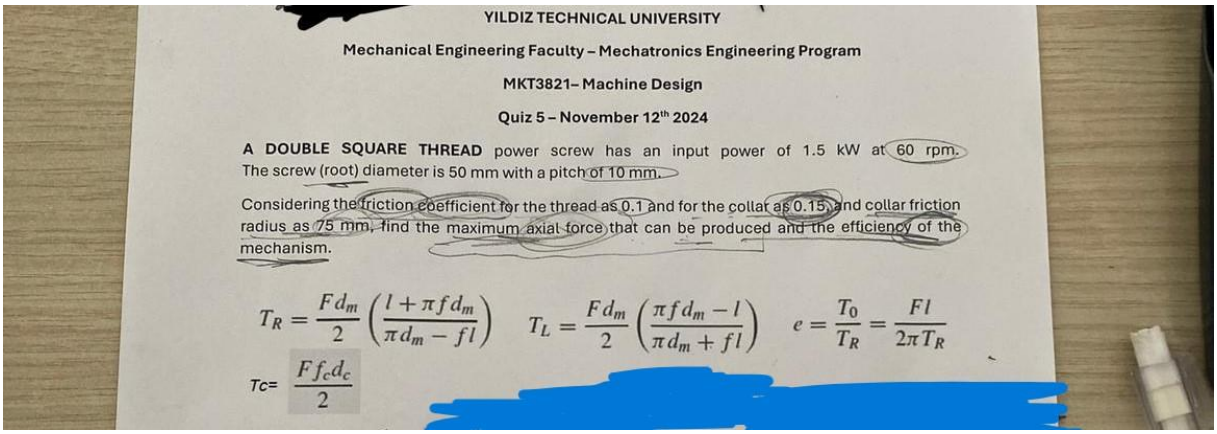
For $F_{max}$ = 20 kN, $F_{min}$ = -20 kN, determine the diameter of the rod according to the infinite life by taking the safety factor S = 2.

The yield strength of the material is $\sigma_y$ = 600 MPa, Surface roughness factor, $K_a$ = 0.8, size factor $K_b$ = 0.6

Use the Soderberg approach if necessary.



# Quiz-5



YILDIZ TECHNICAL UNIVERSITY

Mechanical Engineering Faculty – Mechatronics Engineering Program

MKT3821– Machine Design

Quiz 5 – November 12th 2024

**A DOUBLE SQUARE THREAD** power screw has an input power of 1.5 kW at 60 rpm. The screw (root) diameter is 50 mm with a pitch of 10 mm.

Considering the friction coefficient for the thread as 0.1 and for the collat as 0.15, and collar friction radius as 75 mm, find the maximum axial force that can be produced and the efficiency of the mechanism.

$$T_R = \frac{F d_m}{2}\left(\frac{l + \pi f d_m}{\pi d_m - f l}\right) \qquad T_L = \frac{F d_m}{2}\left(\frac{\pi f d_m - l}{\pi d_m + f l}\right) \qquad e = \frac{T_0}{T_R} = \frac{F l}{2\pi T_R}$$

$T_C = \frac{F f_c d_c}{2}$

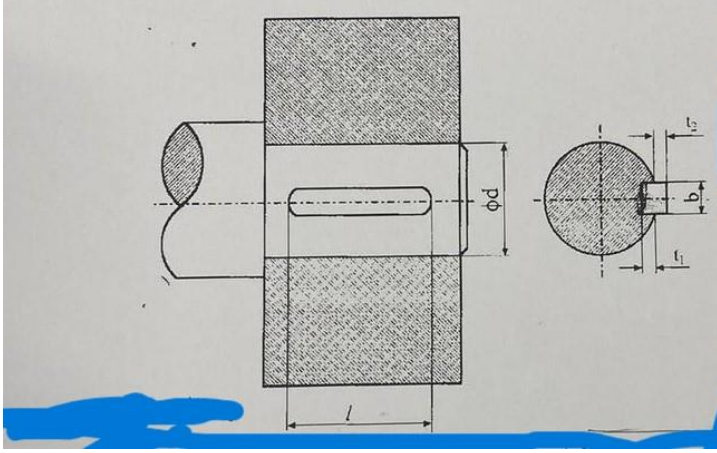
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# Quiz-6

**YILDIZ TECHNICAL UNIVERSITY**
**Mechanical Engineering Faculty – Mechatronics Engineering Program**
**MKT3821– Machine Design**
**Quiz 6 – December 03rd 2024**

**Problem:** A gear is mounted on a shaft by means of a key. The shaft diameter is 30 mm. It is asked to determine the length of the key. Transmitted power is P=**12** kW whereas the angular speed n=1460 rpm. The shaft material is St60 ($S_y$=330 MPa) and gear material is C15 ($S_y$=300 MPa), take the safety factor against compression(crushing) as S=1.5.

The dimension of the key bxh=8x7 mm (whereas $t_1=t_2=3.5$mm), with a shear strength of $\tau_y$ = 150 MPa take the safety factor against shear as S=2.5, and the standard key lengths are l=8, 10, 12, 14, 16, 18, 20 mm



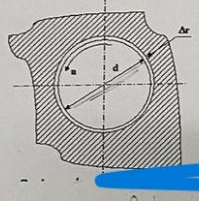

# Quiz-7

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**MKT3821– Machine Design**
**Quiz 7 – December 10th 2024**

The Figure on the left shows a rotating journal under 5000 N load with a speed of 1450 rpm inside a bearing. It is assumed that the centers of both journal and bearing coincide and the gap between them is full of oil. The velocity distribution along the clearance (gap) can be assumed linear. Calculate the torque and power to be applied to the journal to overcome the viscous resistance. (There is no oil flow along the bearing axis. )

***Design values:***
Journal diameter d=65 mm,
Clearance c=60 μm,
Bearing width b=80 mm.
Oil viscosity μ=5.10$^{-2}$ Pa

$$f=2\pi^2\frac{\mu n}{P}\frac{r}{c}$$



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# Quiz-8

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**MKT3821– Machine Design**
**Quiz 8 – December 17th 2024**

Predict the a) equivalent radial load and b) hourly life of the ball bearing for 17 mm bore (02-series) deep-groove ball bearing in a rotating SHAFT loaded with 7 kN radially and 2 kN axially at 1600 rpm.

2 kN

Dimensions and Load Ratings for Single-Row 02-Series Deep-Groove and Angular-Co

| Bore, mm | OD, mm | Width, mm | Fillet Radius, mm | Shoulder Diameter, mm $d_s$ | Shoulder Diameter, mm $d_H$ | Load R Deep Groove $C_{10}$ | Load R Deep Groove $C_0$ |
|---|---|---|---|---|---|---|---|
| 10 | 30 | 9 | 0.6 | 12.5 | 27 | 5.07 | 2.24 |
| 12 | 32 | 10 | 0.6 | 14.5 | 28 | 6.89 | 3.10 |
| 15 | 35 | 11 | 0.6 | 17.5 | 31 | 7.80 | 3.55 |
| 17 | 40 | 12 | 0.6 | 19.5 | 34 | 9.56 | 4.50 |
| 20 | 47 | 14 | 1.0 | 25 | 41 | 12.7 | 6.20 |

| $F_a/C_0$ | $e$ | $F_a/(VF_r) \le e$ $X_1$ | $F_a/(VF_r) \le e$ $Y_1$ | $F_a/(VF_r) > e$ $X_2$ | $F_a/(VF_r) > e$ $Y_2$ |
|---|---|---|---|---|---|
| 0.014* | 0.19 | 1.00 | 0 | 0.56 | 2.30 |
| 0.021 | 0.21 | 1.00 | 0 | 0.56 | 2.15 |
| 0.028 | 0.22 | 1.00 | 0 | 0.56 | 1.99 |
| 0.042 | 0.24 | 1.00 | 0 | 0.56 | 1.85 |
| 0.056 | 0.26 | 1.00 | 0 | 0.56 | 1.71 |
| 0.070 | 0.27 | 1.00 | 0 | 0.56 | 1.63 |
| 0.084 | 0.28 | 1.00 | 0 | 0.56 | 1.55 |
| 0.110 | 0.30 | 1.00 | 0 | 0.56 | 1.45 |
| 0.17 | 0.34 | 1.00 | 0 | 0.56 | 1.31 |
| 0.28 | 0.38 | 1.00 | 0 | 0.56 | 1.15 |
| 0.42 | 0.42 | 1.00 | 0 | 0.56 | 1.04 |
| 0.56 | 0.44 | 1.00 | 0 | 0.56 | 1.00 |

*Use 0.014 if $F_a/C_0 < 0.014$.

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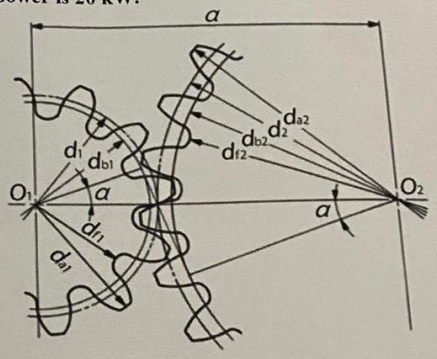
# Quiz-9

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Name :

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**MKT3821– Machine Design**
**Quiz 9 – December 24th 2024**

Considering the mating gears shown in the figure fill the table given below and show your calculations. **The input power is 20 kW.**




| Item | Symbol | Pinion | Gear |
|---|---|---|---|
| Module(mm) | m | 3 | 3 |
| Pressure angle | α | 20 | 20 |
| Number of teeth | Z | **21** | **43** |
| Center distance(mm) | a | | |
| Pitch diameter(mm) | d0 | | |
| Addendum diameter(mm) | da | | |
| Dedendum diameter(mm) | df | | |
| Base diameter(mm) | db | | |
| Gear ratio | i | | |
| Angular speed(rpm) | n | **500** | |
| Output torque (Nm) | Tout | | |

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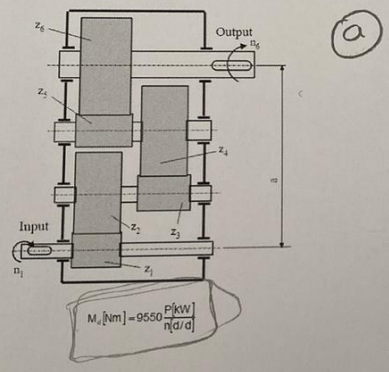
# Quiz-10

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**MKT3821– Machine Design**
**Quiz 10 – December 31th 2024**

The figure schematically shows a three-stage gearbox. All spindle axes are on the same plane.
For 1st stage: number of teeth z1=20, z2=68 module m1-2=2.5 mm
For 2nd stage: number of teeth z3=19, z4=58 module m3-4=3 mm
For 3rd stage: number of teeth z5=22, z6=76 module m5-6=4 mm
Input power P=30 kW and input speed n1=1450 rpm
The efficiency of a single gear pair is 97% for the first stage and 98% for the other stages.
a) Calculate the distance between the input and output shafts (distance a)
b) Find the limits and torque of the output shaft




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