



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2023/2024 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

**BACHELOR OF MECHANICAL AND INDUSTRIAL
ENGINEERING**

COURSE CODE: MIE 361

COURSE TITLE: MACHINE DESIGN II

MAIN PAPER

DATE: 20th December 2023

TIME: 1200 – 1400 HRS

INSTRUCTIONS TO CANDIDATES

1. There are TWO sections (A&B) in this paper.
2. Question ONE has THREE parts, and is compulsory
3. Choose to answer THREE more questions in part TWO
4. Paper lasts 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over

SECTION A (carries a total of 30 marks)

QUESTION ONE (10 marks)

Q (1). A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing. **[10]**

QUESTION TWO (10 marks)

Q2. Give at least SIX Advantages and FOUR Disadvantages of Rolling Contact Bearings Over Sliding Contact Bearings. **[10]**

QUESTION THREE (10 marks)

Q3 a). List the advantages of gear drives as compared to other drives. **[5]**
(b). Name FIVE types of couplings **[5]**

SECTION B (carries a total of 30 marks)

QUESTION FOUR (10 marks)

Q4. A shaft is transmitting power, $N = 100$ kW at a speed, $N = 160$ rpm. Find a suitable diameter, **d** for the shaft, if the maximum torque transmitted exceeds the mean by 25%. Take maximum allowable shear stress to be $\tau = 70$ MPa.

QUESTION FIVE (10 marks)

Q5. A pump is driven by an electric motor through an open type flat belt drive. Determine the belt specifications for the following data:
Motor pulley diameter, $(d_s) = 300$ mm, Pump pulley diameter $(d_L) = 600$ mm .
Coefficient of friction, (μ_s) for motor pulley = 0.25, Coefficient of friction (μ_L) for pump pulley = 0.20 . Centre distance between the pulleys, $C=1000$ mm; Rotational speed of the motor = 1440 rpm; Power transmission = 20kW; density of belt material $(\rho) = 1000$ kg/m³ ; allowable stress for the belt material $(\sigma_b) = 2$ MPa; thickness of the belt, $t_b = 5$ mm. **[10]**

QUESTION SIX (10 marks)

Q6. A design of a wheel of a Toyota 4D Hilux pick-up is shown in fig. Q6 . The conical shaft is to be bolted firmly to the frame chassis of the vehicle. Study the assembly carefully; and you should find mistakes in it. Re-sketch the assembly in order to correct at least 10 mechanical design mistakes in this drawing. **[10]**

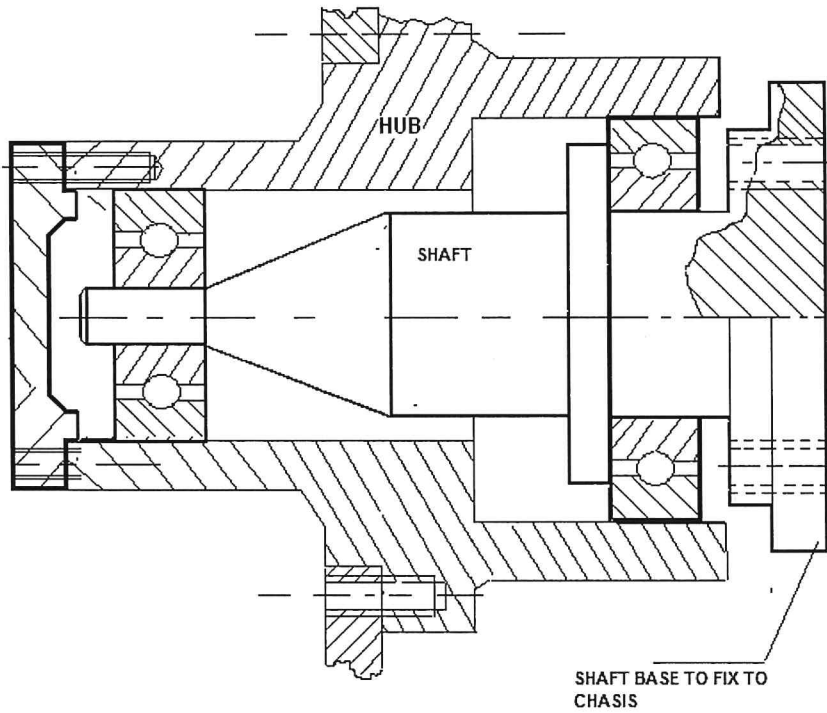


Fig.Q6

QUESTION SEVEN

(10 marks)

Q##7 Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa. **[10]**

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