

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2022

B. Tech. (ME), Semester VI, 2021-22

Roll No.....

ME1110: Design of Machine Elements

Time: 3 hours

Max. Marks: 50

Instructions to students:

1. Design Data Book is allowed in Exam.
 2. Do not write anything other than your roll number on question paper.
 3. Mention all the assumptions for your answers clearly.
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| Q. 1.1 Herringbone gear is used for. | 2.0
(CO 3) |
| Q. 1.2 Where do you use self-aligning ball bearings and spherical roller bearings? | 2.0
(CO 3) |
| Q. 1.3 Important observations obtained from Petroff's equation are. | 2.0
(CO2) |
| Q. 1.4 Suggest the type of sliding contact bearing use for rope conveyors also mention two advantages of hydrodynamic bearings over hydrostatic bearings. | 2.0
(CO2) |
| Q. 2.1 State two important reasons for adopting involute curve for gear tooth profile. | 6.0
(CO 3) |
| Q. 2.2 A ball bearing is subjected to a radial force of 2500 N and an axial force of 1000 N. The dynamic load carrying capacity of the bearing is 7350 N. The values of X and Y factors are 0.56 and 1.6 respectively. The shaft is rotating at 720 rpm. Calculate the life of the bearing. | 6.0
(CO 2) |
| Q. 2.3 A taper roller bearing has a dynamic load capacity of 26 kN. The desired life for 90% of the bearings is 8000 h and the speed is 300 rpm. Calculate the equivalent radial load that the bearing can carry. | 6.0
(CO3) |
| Q. 3.1 The following data is given for a pair of spur gears with 20° full-depth involute teeth: number of teeth on pinion = 24 number of teeth on gear = 56, speed of pinion = 1200 rpm, module = 3 mm, service factor = 1.5 and face width = 30 mm. Both gears are made of steel with an ultimate tensile strength of 600 N/mm ² .
Using the velocity factor to account for the dynamic load, calculate
(i) beam strength
(ii) velocity factor;
(iii) rated power that the gears can transmit without bending failure, if the factor of safety is 1.5. | 8.0
(CO3) |
| Q. 3.2 A pair of parallel helical gears consists of an 18 teeth pinion meshing with a 45 teeth gear. 7.5 kW power at 2000 rpm is supplied to the pinion through its shaft. The normal module is 6 mm, while the normal pressure angle is 20°. The helix angle is 23°. | 8.0
(CO3) |

Determine the tangential, radial and axial components of the resultant tooth force between the meshing teeth

- Q. 3.3 Design a 360° journal bearing for a Centrifugal pumps, known parameters are Journal diameter = 100 mm, radial load = 50000 kN, Journal speed = 1000 rpm, Type of oil is SAE 10, for which the absolute viscosity at 55°C=0.017kg/m-s, Ambient temp of oil =15 °C,Maximum bearing pressure por the pump= 1.5N/mm².

8.0
(CO2)

Calculate also the mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232W/m²/°C.

(note: refer table for reference)

Machinery	Bearing	Maximum bearing pressure (p) in N/mm ²	Operating values			
			Absolute Viscosity (Z) in kg/m-s	ZN/p Z in kg/m-s p in N/mm ²	$\frac{c}{d}$	$\frac{l}{d}$
Railway cars	Axle	3.5	0.1	7	0.001	1.8 – 2
Steam turbines	Main	0.7 – 2	0.002 – 0.016	14	0.001	1 – 2
Generators, motors, centrifugal pumps	Rotor	0.7 – 1.4	0.025	28	0.0013	1 – 2
Transmission shafts	Light, fixed	0.175	0.025-	7	0.001	2 – 3
	Self-aligning	1.05	0.060	2.1		2.5 – 4
	Heavy	1.05		2.1		2 – 3
Machine tools	Main	2.1	0.04	0.14	0.001	1-4
Punching and shearing machines	Main	28	0.10	—	0.001	1-2
	Crank pin	56				
Rolling Mills	Main	21	0.05	1.4	0.0015	1-1.5

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all the best!