

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2536 Roll No.

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B.Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

MACHINE DESIGN—II

Time : 3 Hours

Total Marks : 100

Notes :—(i) Attempt all questions.

(ii) Assume any missing data suitably.

(iii) Use of design data book is permitted.

1. Attempt any **two** parts of the following :— (10×2=20)

(a) Describe the law of gearing. Why involute teeth are preferred over cycloidal teeth ? What is the reason of interference in gears and how it can be avoided ?

(b) A pair of spur gear with 20° full depth involute teeth has pinion with 24 teeth and gear with 72 teeth. The pinion speed is 3000 rpm and it transmits 35 kW. The permissible static bending stress for the material of both the gears is 140 MPa. Design the gear.

(c) Two parallel shafts with center distance 200 mm are to be connected by 20° full depth spur gear and pinion for a speed ratio of 3 : 1. The speed of the pinion is 600 rpm. Module and width of the gear and pinion are 5 mm and 50 mm respectively. The safe static stresses for pinion and gear are 110 and 55 MPa respectively. Find maximum power that can be transmitted safely.

2. Attempt any **two** parts of the following :— (10×2=20)

(a) Two precision cut forged steel helical gears have 20° full depth involute teeth. The helix angle is 23° and permissible static bending stress is 100 MPa. If gear ratio is 3 : 1, module is 3 mm, face width is 300 mm and surface endurance strength is 630 MPa; find the power transmitted and wear load and state whether the design is safe. The speed of pinion is 600 rpm.

(b) Design a worm and worm gear drive for a speed reduction by 25. Worm rotates at 600 rpm and transmits 35 kW. Assume double start thread and gear has 50 full depth 20° involute teeth.

(c) Using a suitable schematic diagram explain the forces acting on worm gears. Also, define normal pitch, helix angle and efficiency of worm gear drive.

3. Answer any **two** parts of the following :— (10×2=20)

(a) A deep groove ball bearing has dynamic capacity of 20000 N and is to operate on the following work cycle; Radial load of 6000 N at 200 rpm for 25% time, radial load of 9000 N at 500 rpm for 20% of the time and radial load of 3500 N at 400 rpm for the remaining period. Assuming the loads are steady and the inner race rotates, find the average expected life of the bearing in hours.

- (b) Select a suitable bearing for a 40 mm shaft that has to operate 8 hours per day, 5 days per week for 5 years and is to carry a stationary radial load 2500 N at 1500 rpm. The use involve minor shock and inner ring is rotating.
- (c) What are the main components of the rolling contact bearing. Describe basic static load capacity, basic dynamic load capacity and life of bearing.
4. Attempt any **two** parts of the following :— (10×2=20)
- (a) Differentiate between hydrodynamic lubrication, wedge film lubrication and squeeze film lubrication. What are the advantages and limitations of journal bearing ?
- (b) A full journal bearing of diameter 80 mm and length 120 mm is to support a load of 20 kN at the shaft speed of 1500 rpm. The bearing temperature is to be limited to 75° and the ambient room temperature is 38°. The viscosity of oil used is 0.0088 kg/m-s at 115°. Check if artificial cooling is required and find the amount of artificial heating.
- (c) Design a journal bearing to support a load of 5 kN at 1000 rpm using a hardened steel journal and bronze backed babbitt bearing. The bearing is lubricated by oil rings. Assume room temperature as 25° and the oil temperature as 77°.

5. Attempt any **one** part of the following :— (20×1=20)

(a) The cylinder of a slow speed steam engine is 250 mm diameter and the steam pressure 1 N/mm². The piston rod length is 1000 mm and the connecting rod is 1.2 m long. The engine stroke is 550 mm. Determine the dimensions of the cross section of the connecting rod assuming the depth to be twice as thickness and a suitable diameter for the piston rod.

(b) A four stroke diesel engine has the following specifications :

Brake power : 12 kW

Speed : 1500 rpm

Indicated MEP : 0.35 N/mm²

Mechanical efficiency : 80%

Determine :

(i) bore and length of the cylinder,

(ii) thickness of the cylinder head, and

(iii) size of stud for the cylinder head.