

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

PAPER ID : 4051

Roll No.

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B.Tech.

SIXTH SEMESTER EXAMINATION, 2005-2006

MACHINE DESIGN - II

Time : 3 Hours

Total Marks : 100

Note : (i) Answer **ALL** questions.

(ii) All questions carry equal marks.

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your answer.

- 001390
1. (a) What is conjugate action ? How is it achieved in the case of involute gears ? 5
- (b) The pinion in a spur gear set having a speed ratio 3 rotates at 900 RPM and has 20 full depth teeth of pressure angle 20° . The face width is 30 mm and the module is 3 mm. What is the power rating of the gear set based only on tooth bending strength if both the gear and pinion are made of the same material having an ultimate strength of 400 MPa and an yield strength of 210 MPa ? Assume a factor of safety of 2. 15

OR

ME—603

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[Turn Over

A 20° normal pressure angle helical pinion having 20 teeth and helix angle of 30° transmits 3kW at 30 rev/sec. The speed ratio is 4, normal module is 4 mm and the face width is 36 mm. Calculate the maximum contact stress in the tooth if the gear and pinion are made of steel.

2. (a) Explain briefly any two gear cutting methods indicating their relative advantages. 5
- (b) With the help of a sketch, explain how an axial thrust is generated in a helical gear. 5
- (c) A straight bevel gear mesh for shafts intersecting perpendicularly transmits 4 kW with a gear ratio of 3. The pinion speed is 15 rev/sec, normal pressure angle is 20° and has 20 teeth with a net face width of 26 mm. Estimate the safety factor against bending and wear for the pinion if the allowable stress levels are 80 MPa in bending and 900 MPa in contact stress. The module at the large end is 4 mm. 10

OR

Find the 20° involute worm and gear which will transmit 15kW between shafts that are 0.30 meter apart, if the speed reduction is to be 10.5 to 1, and the driving shaft is turning at 1200rpm. 10

3. (a) Indicate with proper justification the typical situations for which the following type of antifriction bearings is to be used exclusively 5
- Deep groove ball bearing
Roller bearing
Needle bearing
Angular contact ball bearing

- (b) Select a deep groove ball bearing for a shaft of diameter 20 mm running at a speed of 1000 rpm. The required bearing life is 5000 hours at a reliability of 99 %. The radial load is 2.5 kN and the axial load is 1.2 kN. The maximum operating temperature is 40°C and inner race rotates. 15

OR

Select a suitable roller bearing to carry a radial load of 10,000 N. The shaft rotates at 1000 rpm, average life is 5000 hours. Inner race rotates. Take mild shock. 15

4. (a) For a given journal bearing with fixed clearance and radius, plot the variation of the coefficient of friction with the Sommerfeld number and explain the stable and unstable regimes of operation. 5
- (b) List the important characteristics desired for a good journal bearing material. 5
- (c) A journal bearing has a journal diameter of 50 mm and the diameter of the bushing is 50.1 mm. The bushing is 50 mm long and has to support a load of 1 kN at a speed of 1200 RPM. Determine the minimum oil film thickness and power loss for SAE 10 oil assuming the oil film temperature to be 70°C. 10

OR

Design a self contained journal bearing to support a load of 4500 N at 600 rpm using hardened steel journal and a bronze backed babbitt bearing. Take room temperature as 21°C and average oil temperature as 80°C 10

5. Design a cast iron piston for a single acting four stroke engine for the following: 20

Cylinder bore = 100mm

Stroke = 120mm

Max. gas pressure = 5 N/mm²

Brake mean effective pressure = 0.65 N/mm²

Fuel consumption = 0.227 kg/kW/hr

Speed = 2200 rpm

Assume suitable data if required.

OR

20

Design a connecting rod for four stroke petrol engine with the following data :

Piston diameter = 0.10 m

Stroke = 0.14 m

Length of connecting rod, centre to centre = 0.315m

Weight of reciprocating parts = 18.2 N

Speed = 1500 rpm with possible over speed of 2500

Compressor ratio = 4:1, Probable Max explosion pressure = 2.45 MPa