

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VI MECHANICAL : WINTER- 2022
SUBJECT : MACHINE DESIGN-II

Day : Thursday

Time : 10:00 AM-02:00 PM

Date : 24-11-2022

W-13450-2022

Max. Marks : 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data if necessary.
- 4) Draw neat diagrams **WHEREVER** necessary.

Q.1 Explain in detail what are the principles of designing casting components. (10)

OR

What are principles of designing forging components? (10)

Q.2 A pair of spur gears with 20° pressure angle, consist of a 25 teeth pinion meshing with a 60 teeth gear. The module is 5 mm while the face width is 45 mm. The pinion rotates at 500 rpm. The gears are made up of steel and heat treated to surface hardness of 220 BHN. Assume that dynamic load is accounted by means of the velocity factor. The service factor and the f.o.s. are 1.75 and 2 respectively. Calculate (10)

Calculate

- i) Wear strength of gears
- ii) The static load that the gears can transmit without pitting
- iii) Rated power that can be transmitted by gear.

(Assume suitable data if necessary)

OR

The following data is given for a pair of spur gears with 20° full depth involute teeth. The number of teeth on pinion = 24, number of teeth on gear = 56, speed of pinion = 1200 r.p.m, Module = 3 mm, Service factor = 1.5, Face width = 30 mm. (10)

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 (Assume suitable data if necessary)

Q.3 The following data is given for a steel helical gear pair (10)

Power transmitted = 20 kw

Pinion Speed = 720 r.p.m

Number of teeth on pinion = 35

Number of teeth on gear = 70

Normal pressure angle = 20°

Helix angle = 23°

Face width = 40 mm

Velocity factor = $5.6 / (5.6 + \sqrt{v})$

Ultimate tensile strength for steel = 600 N/mm^2

Service factor = 1.5

Factor of safety = 2

Deformation factor, $C = 11400e$ for steel

For grade 6 $e = 8 + 0.63 [m_n + 0.25 \sqrt{d}]$

Estimate

- i) Normal module
- ii) The beam strength
- iv) The dynamic load using Buckingham's equation and
- v) The surface hardness for the gears and check the wear strength of the gear.

vi) Take $Y = 0.484 - \frac{2.87}{Z'}$

OR

The following data is given for a steel helical gear pair transmit at 150 kw (10)
power from a shaft rotating at 1440 r.p.m to another parallel shaft rotating at
360 r.p.m

Centre distance = approximately 435 mm

Helix angle = 24°

Face width = $14 m_n$ (14 times normal module)

Number of teeth on pinion = 20

Permissible bending stress for pinion material = 152 N/mm^2

Permissible bending stress for gear material = 125 N/mm^2

Tooth system = 20° full depth involute

Service factor = 1.53

Combined teeth error = 0.0406 mm

Deformation factor = $11600 e \text{ N/mm}$

Assume the dynamic load is accounted by the Buckingham's equation ,

Calculate

i) The factor of safety against bending failure

ii) The surface hardness if the f.o.s against pitting failure is 1.5

Take $Y_p' = 0.3463$ $Y_g' = 0.4473$

- Q.4 A shaft of length 1.2 m is supported on two identical single row deep groove (10)
ball bearing. The shaft is fixed with a gear at it's center which is rotating at
720 r.p.m. The tangential and radial force components for the gears are 1 kN
and 0.8 kN respectively. The expected life of the bearing is 15000 hours with
a reliability of 80 %. Neglecting the effect of axial force (if any), Calculate the
dynamic load rating for the bearings, So that they can directly be selected from
the manufactures catalogue. Assume load factor of 1.25.

OR

A transmission shaft is supported by two deep groove ball bearings at two (10)
ends. The center distance between the bearings is 160 mm. A load of 300 N
acts vertically download at 60 mm distance from the left hand bearing where
a load of 550 N acts horizontally at 50 mm distance from the right hand
bearings. Shaft speed is 3000 r. p.m and expected life of bearing is 7000 hour
with a reliability of 95%, it is intended to use same bearing at both ends of the
shaft, calculate dynamic load rating of the bearing so that it can be selected
from manufactures catalogue. Take service factor of 1.75 and inner race is
rotating.

- Q.5 Write a note on properties of bearing materials. (10)

OR

Give classification of sliding contact bearings and explain in detail (10)
Hydrodynamic bearing.

- Q.6 A flat belt is used to transmit 15 kw power from a pulley running at 1440 r.p.m (10)
to another pulley running at 480 r.p.m. The centre distance between the pulleys
is twice the diameter of larger The belt velocity is 20.35 m/s, while the
maximum allowable tensile stress in the belt is 2.25 MPa. The density of belt
material is 0.95 gm/cc and the coefficient of friction between the belt and
pulley is 0.35. if the thickness of the belt is 5 mm,

Calculate

i) Diameter of both pulleys

ii) The length and width of belt

iii) Belt tension

OR

Explain the following (10)

i) Designation of wire rope

ii) Application of wire rope

iii) Lay of wire ropes