Qu1 Derive the expression for Lewis beam strength equation with proper assumption for spur gear. [2018-2019]

Qu2. A 20° full depth involute pair of spur gear is to be designed. Driving shaft rotates at 750 rpm & receive a 7.5 KW power, speed reduction of output shaft is 2 min times. The gear are made of steel with σ_{ut} = 480 MPa. Service factor is 1.5 and face width is 9.5 times of module. The gear are machined to the accuracy of Grade 8. Assume a pitch line velocity of 3.6 m/s, factor of safety is 2 & deformation factor is 11.4 GPa. Estimate the module of the gear & determine the dynamic load using Buckingham's equation. [2018-19]

Qu3 A single bronze spur pinion rotating at 800 rpm drives a cast iron spur pinion gear at a transmission ratio 4:1. The allowable static stresses for the bronze pinion & cast iron gear are 90 MPa & 110 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gear is 85 mm. Find the power that can be transmitted from the standpoint of strength. [2017-18]

Qu4. A motor shaft rotating at 1500 rpm has to transmit 10 KW to a low speed shaft with speed reduction of 3:1. The teeth are 14½° involute with 24 teeth on the pinion. Both the pinion & gear are made of steel with a max. safe stress of 200 MPa. A safe stress of 45 MPa may be taken for the key. Design a spur gear drive to suit the above conditions. Assume a shaft on which the gear is mounted & for the key. Design a spur gear drive to suit the above conditions. Assumes starting torque to be 30% higher than the running torque. [2017-2018]

Que. A pair of parallel helical gears consists of 25-teeth pinion meshing with a 120 teeth gear. Normal pressure angle is $20°$ & helix angle is $25°$. The pinion rotates at 800 rpm. Normal module of gear is 5mm & face width is 50 mm. Both pinion & gear are made of steel with allowable bending strength of 330 MPa. Gears are heat treated to a surface hardness of 380 BHN. What power can be transmitted by gear if service factor is 1.3? Assume pitch line velocity factor takes into account for dynamic load. [2018-19]

Que. A pair of parallel helical gears consists of an 18 teeth pinion meshing with a 45 teeth gear. A 7.5 kw power at 2000 rpm is supplied to the pinion through its teeth gear. A shaft. The normal module is 6mm, while the normal pressure angle is $20°$. The helix angle is $23°$. Determine the tangential, radial & axial component of the resultant tooth force b/w the meshing teeth. [2018-19]

Que. A pair of helical gears are to transmit 15 kw. The teeth are $20°$ stub in diametrial plane and have a helix angle of $45°$. The pinion runs at 10000 rpm & has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gear are made of cast steel having allowable static strength of 100 MPa; determine a suitable module & face width from static strength consideration & check the gear for wear, given $\sigma_{es} = 618$ MPa. [2016-17]

Que A pair of worm gear is designated as 3/60/8/5. The worm rotates at 720 rpm & normal pressure angle is 20°. Worm is made of case hardened steel, & the gear of porphor bronze & worm set is well lubricated. Determine the power lost due to friction when power input is 1 kW. [2018-19]

Que Design a worm & worm gear drive for a speed reduction of 30. Worm rotates at 720 rpm & transmits 40 kW. Assume double start thread & gear has 6° full depth 20° involute teeth. [2018-19]

Que A pair of straight bevel gear is mounted on shafts, which are intersecting at right angles. The number of teeth on the pinion and gear are 40 & 65 respectively. The pressure angle is 20°. The pinion shaft is connected to an electric motor developing 16.5 kW rated power at 600 rpm. The service factor can be taken as 1.5. The pinion & the gear are made of steel ($S_{ut} = 580 \ N/mm^2$) & heat treated to a surface hardness of 320 BHN. The gears are manufactured in such a way that the error b/w two meshing teeth is limited to 21 microns. The module & face width are 6mm & 50 mm, respectively. Determine the factor of safety against bending & pitting failure. [2018-19]

Que A pair of bevel gear is required to transmit 11 kW at 500 rpm from the motor shaft to another shaft, the speed reduction being 3:1. The shafts are inclined at 60°. The pinion is to have 24 teeth with a pressure angle of 20° & is to be made of cast steel having a static stress of 80 MPa. The gear is to be made of cast iron with a static stress

of 55 MPa. The tooth form factor may be taken as $y = 0.154 - \dfrac{0.912}{TE}$, where TE is formative no. of teeth. The velocity factor may be taken as $3/(3+v)$, where v is the pitch line velocity in m/s. The face width may be taken as $1/4^{th}$ of the slant height of the pitch cone. The mid-plane of the gear is 100 mm from the left hand bearing & 125 mm from the right hand bearing. The gear shaft is to be made of colled-rolled steel for which the allowable tensile stress may be taken as 80 MPa. Design the gear & the gear shaft. [2017-18]

Que. A worm drive transmit 20 kW at 2500 rpm to a machine carriage at 70 rpm. The worm is triple threaded & has 60 mm pitch diameter. The worm gear has 85 teeth of 6mm module. The tooth form is to be $20°$ full depth involute. The coefficient of friction between the mating teeth may be taken as 0.10. Calculate the tangential force acting on the worm & axial thrust & separating force on worm. Also calculate the efficiency of the worm drive. [2017-18]

Que. A worm drive transmit 15 kW at 2000 rpm to a machine carriage at 75 rpm. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6mm module. The tooth form is to be $20°$ full depth involute. The co-efficient of friction between the mating teeth may be taken as 0.10. Calculate (1.) tangential force acting on the worm (2) axial thrust & separating force on worm; (3) efficiency of the worm drive. [2016-17]

Que. Explain the mechanism of Hydrostatic & Hydrodynamic lubrication. Write five difference between them. [2018-19]

Que. Following data is given for a full hydrodynamic bearing,
Radial load = 25 KN
Journal Speed = 1000 rpm
Unit bearing pressure = 2.5 MPa
Viscosity of lubricant = 20 cP
L/D = 1
Ratio of minimum film thickness to radial clearance = 0.25
Determine: (i) dimensions of the bearing
(ii) minimum film requirement
(iii) requirement of oil flow.   [2018-19]

Que. What are the various terms used in Hydrodynamic Journal Bearing? Each explain each term with neat sketch. [2017-18]

Que. The load on the journal bearing is 150 KN due to turbine shaft of 300 mm diameter running at 1800 rpm. Determine the length of the bearing if the allowable bearing pressure is 1.6 N/mm², & amount of heat to be removed by the lubricant per minute if the bearing temperature is 60°C & viscosity at the oil at 60°C is 0.02 kg/m-s & the bearing clearance is 0.25 mm. [2017-18]

Que. What are the materials used for sliding contact bearings.
A journal bearing 60 mm is diameter are 90 mm long runs at 450 rpm. The oil used for hydrodynamic lubrication has absolute viscosity of 0.06 kg/m-s. If the diametric clearance is 0.1 mm, find the safe load on the bearing. [2017-18]

Que. A 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0.05 mm & the viscosity of the oil is 0.021 kg/m-s at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the max. safe speed. [2016-17]

Ques. A full journal bearing of 50 mm diameter & 100 mm long has a bearing pressure of 1.4 N/mm². The speed of the journal is 900 rpm & the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temp. of 75°C may be taken as 0.011 kg/m-c. The room temp is 35°C. Find : (1) The amount of artificial cooling required, and (2) The mass of the lubricating oil required, if the difference b/w the outlet & inlet temperature of oil is 10° C. Take specific heat of the oil as 1850 J/kg/°C. [2016-17]

Ques.
(i) What do you mean by lubrication? Classify thick film lubrication
(ii) What are stable & unstable lubrications? Explain with the help of bearing characteristic number. [2012-13]

Ques. Differentiate between hydrodynamic lubrication, wedge film lubrication & squeeze film lubrication. What are the advantages & limitations of journal bearing. [2011-12]

Question Bank

Ques. What do you mean by hydrodynamic lubrication? [2018-19] [2006-07]

Ques. What is meant by hydrodynamic lubrication in bearing? [2017-18]

Ques. Explain the terms as applied to journal bearings [2017-18] [2016-17]
(a) Bearing Characteristic number
(b) Bearing modulus

Ques. Explain wedge film and squeeze film journal bearing [2016-17]

Ques. Define the term [2003-04]
(a) Bearing modulus [2004-05]
(b) Min. film thickness
(c) Sommerfeld number [2004-05]
(d) Operating oil temp

Ques. Distinguish between 'Hydrodynamic bearing' and 'Hydrostatic bearing' [2004-05]

Ques. For a given journal bearing with fixed clearance (c) and radius (r, plot the variation of coefficient of friction (μ) with sommerfeld number (S) & explain the stable and unstable regimes of operation. (2005-06)

Ques. List the important characteristic desired for good journal bearing material. [2005-06]

Ques. Answer the following — [2007-08]

) Effect of clearance on bearing performance
Imp. consideration for selection of bearing
Material used for sliding contact bearing
variation of coefficient of friction with bearing modulus.

Write a note on 'lubricants used in sliding contact bearing [2008-