QUESTION BANK

SPUR GEAR

1. What do you mean by interference and undercutting of gear? How it can be avoided?
2. What is contact ratio? How it can be increased?
3. Discuss causes & remedies of gear tooth failure.
4. A spur gear pair made of plain carbon steel 55C8 (σut = 720 N/mm2 and E = 210 GPa) is required to transmit 7.5 kw power from an electric motor running at 1440 rpm to a machine running at 370 rpm. The tooth system is 20o full depth involute and no. of teeth on pinion are as minimum as possible. The service factor and load concentration factor are 1.25 and 1.2 respectively. The factor of safety required is 1.25 to 1.5. The face width is twelve times the module. The gears are to be machined to meet the specifications of grade 7. Design the gear pair by using the velocity factor Kv = 3/ (3+v) and buckingham's equation for dynamic load. Suggest the case hardness for gear pair. Use the following relations.
5. A pair of spur gear with 20o full depth involutes teeth needs to be designed. Input shaft rotates at 800 rpm and receives 6 kW power. Speed reductions of output shaft by 5 times. Pinion and gear are made of steel with σut= 450 N/ mm2 service factor is 1.3. The gears are machined to accuracy of grade 10. Assume a pitch line velocity of 3.6 m/s and FOS is 2. Estimate the module of the gear teeth. Determine static and dynamic load from Spott's equation. Specify the surface hardness of gear teeth assuming that strength in bending is the same as strength in wear.

HELICAL GEAR

1. The following data is given for a pair of helical gears made of steel:
   Normal module = 5 mm,
   Face Width = 50 mm,
   No. of Pinion Teeth = 30,
   No. of Gear Teeth = 60,
   Centre distance = 245 mm,
   Normal Pressure angle =200,
   Pinion speed = 1000 r.p.m,
   surface hardness = 300 BHN,
   FOS = 2 Service Factor = 1.5,
   Grade of Machining = 8,
   Tooth form factor (Y) = 0.385
   Permissible σb for pinion and gear material=150N / mm2.
   Determine:(i) Helix angle (ii) Beam strength (iii) Max. Static load that gear can transmit (iv) Power transmitting capacity
2. A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kw at a pinion speed of 1200 rpm. The speed ratio is 3:1 for medium shock condition and 24 hr operation. Determine module, face width, no. of teeth in each gear. Specify material & heat treatment. The teeth are 20o full depth in the normal plane.

3.

BEVEL GEAR

1. A pair of straight bevel gears, manufactured by generation, consists of 14 teeth pinion meshing with 85 teeth gear. The module at large end is 5.5 mm while the face width is limited to 0.25 times the slant height. The pinion is made of steel having ultimate tensile strength is 750 N / mm2 and surface hardness of 210 BHN. The gear is made of cast iron having ultimate tensile strength 260 N / mm2 and surface hardness of 210 BHN. The shaft angle is 900. If the pinion rotates at 750 rpm, estimate the power that gear pair can transmit

WORM GEAR

1. The speed reducer unit is to be designed for an input of 2 kw at 1600 rpm. The velocity ratio is 25. The worm is to be made of hardened steel and the gear of phosphor bronze having a static stress of 70 MPa. The approximate distance between two shafts is 120 mm. Taking a velocity factor $K_v = 6/6+v$

   And tooth form factor $y= 0.154- 0.912/Z_g$ and a wear factor of 0.7 find

   i. Standard module of gear

   ii. Face Width of the gear & length of worm

   iii. Check the design for wear load

2. Explain thermal consideration while designing worm and worm wheel drive.

DESIGN OF GEARBOX

1. A speed gearbox for a head stock of a lathe machine is to give speed variation from 125 rpm to 1500 rpm in 12 steps. The power is supplied to the input shaft by an electric motor of 5 kW running at 1500 rpm, through a belt drive, giving speed reduction 1.2:1. Find the speed steps arranged in geometric progression. Draw the structural diagram, Ray diagram and speed charts.
2. What are the basic considerations in design of multi speed gearbox?
3. Which conditions should be satisfied by optimum structure diagram of multi speed gear box?
4. Explain what is structural diagram and method of drawing structural diagram of gear box.
5. Design a suitable speed gear box for a head stock of a lathe that has a variation of speed from 105 rpm to 690 rpm in 09 steps. The power is supplied by an electric motor of 10 kw capacity running at 1000 rpm and driving the input shaft through a V belt drive having a speed reduction of 2:1. Draw the structural diagram, speed chart and determine the number of teeth on each gear.

HYDRAULIC JOURNAL BEARING

1. Terms used For Hydraulic Journal Bearing.
2. Explain different Properties of Lubricants.
3. Explain Heat Generated in Journal Bearing

ROLLING CCONTACT BEARING

1. Explain Different Types Rolling Contact Bearings
2. Explain Different Basic Dynamic Load Rating of Rolling Contact Bearing

CCOMPONANT OF I.C. ENGINE

1. Following data is given for a diesel engine:
   Cylinder bore = 100 mm,
   Length of connecting rod = 350 mm,
   FOS = 6,
   Maximum gas pressure = 4 MPa,
   l/d Ratio for piston pin bearing = 2,
   l/d Ratio for crank pin bearing = 1.3,
   Allowable bearing pressure for piston pin bearing = 12 MPa
   Allowable bearing pressure for crank pin bearing = 7.5 MPa
   Determine: (i) Dimensions of cross section of the connecting rod (ii) Dimensions of small and big end bearings of connecting rod.

2. Write the procedure to design a centre crankshaft subjected to maximum bending moment with neat sketch.
3. The following data is given for a single cylinder four stroke diesel engine having CI Piston: Cylinder bore = 0.30 m, Stroke length = 0.375 m, Speed = 500 rpm Maximum gas pressure = 8 MPa, Break Mean effective pressure = 1.15 MPa Break specific fuel consumption = 0.22 kg/ kW –h, H.C.V. of fuel = 42000 kJ/kg, Thermal conductivity factor = 46.5 W / m 0C, Allowable tensile stress = 37.5 N/ mm2 Temperature difference between centre and edge of piston head is 2200C Assume 5% of the total heat is developed in cylinder is transmitted by piston. Design (1) Piston Head (2) Piston pin.

4. Find the thickness of a piston crown based on thermal considerations for 4 stroke engine with following specifications:
   Engine speed = 1500 rpm
   Piston diameter = 87 mm
   Length of stroke = 96 mm
   Brake mean effective pressure = 0.7 N/mm2
   BSFC = 0.26 kg/kw-h vi. l/r ratio = 04
   Heat conducted through crown = 10% of heat generated during combustion
   Calorific value of fuel = 42 MJ/kg
   Assume that the piston is made of aluminum alloy with thermal conductivity of 175 w/moc and allowable temperature difference of 111 oc.

MATERIAL HANNDLING SYSTEM

1. What are the advantages and disadvantages of aluminum piston over cast iron piston?
2. What are the different types of piston rings? State its functions. Why is more number of thin piston rings preferred over small number of thick rings?
3. What are the various factors to be consider for selecting material handling equipments for given application?
4. Explain the concept of material handling system design.