B.TECH. SEM -VI MECHANICAL 2014 COURSE (CBCS) :
WINTER - 2017
SUBJECT : MACHINE DESIGN – II

Day : **Monday** Time : **10.00 AM TO 02.00 PM**
Date : **20/11/2017** **W-2017-2224** Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.

Q.1 Explain briefly the different casting processes. Also write note on the design of castings. **[10]**

OR

What are fits and tolerances? What are the commonly used fits and tolerances according to Indian standards? **[10]**

Q.2 A pair of spur gears with 20^0 full depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 N/mm^2. The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75 Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that the gears can transmit. **[10]**

OR

A spur gear pair is to be used to transmit 3 kW power from an electric motor running at 1440 rpm to a pump running at 720 rpm. The centre to centre distance between the axis of the pinion and gear should be exactly 180 mm. The gear pair is to be made of plain carbon steel 50C4 having permissible banding stress of 100 MPa. The total error in meshing teeth is 10 microns and deformation factor is 11400e, N/mm. Assuming service factor, load distribution factor and factor of safety as one. Design the gear pair and suggest surface hardness. Use following data: **[10]**

Velocity factor $Kv = \frac{6}{6+V}$, Dynamic load $Fd = \frac{21V\left(bc + Ft_{max}\right)}{21V + \sqrt{bc + Ft_{max}}}$

Standard module in mm: 1, 1.125, 1.5, 2.0, 2.5, 3, 4, 5, 6, 8, 10, 12, 16, 20.

Q.3 The following data is given for a steel helical gear pair transmitting 150kW power from a shaft rotating at 1440 rpm to another parallel shaft rotating at 360 rpm. **[10]**

Centre distance	= approximately 435 mm
Helix angle	= 24^0
Face width	= 14 mm
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	= 20^0 full depth involute
Service factor	= 1.53
Combined teeth error	= 0.0406 mm
Deformation factor	= 11600 e N/mm

Assuming the dynamic load is accounted by the Buckingham's equation and Lewis form factor for gear and pinion are 52.60 N/mm^2 and 55.90 N/mm^2 respectively. Determine i) the factor of safety against bending failure
ii) the surface hardness, if the factor of safety against pitting failure is 1.5.

P.T.O.

OR

A right hand 18 teeth helical pinion, rotating at 1440 rpm transmit 22 kW power to a left hand, 40 teeth helical gear mounted on parallel shaft. The normal module is 6 mm and tooth system is 20^0 full depth involute. The helix angle is 23^0. The pinion is above the gear and is rotating in clockwise direction when viewed from the right side. Determine the components of force acting on meshing teeth. **[10]**

Q.4 A shaft with centrally mounted helical pinion is supported on deep-groove ball bearings on both ends. The centre distance between bearings is 100 mm. The shafts transmits 5 kW power at 3000 rpm. The pitch circle diameter of pinion is 80 mm. The normal pressure angle and helix angle are 20^0 and 25^0 respectively. The required reliability of the bearing is 95% with a life of 8000 hours. Find the dynamic load capacity of the bearings so that the bearings are selected from the manufacturing catalogue. Assume: **[10]**

a) Shock load factor = 1.25
b) Radial load factor = 0.56
c) Thrust load factor = 1.2

OR

a) Write a short note on selection of bearing life. **[05]**
b) Sketch the face to face and back to back arrangements for taper roller bearings. **[05]**

Q.5 The following data is given for a 360^0 hydrodynamic bearing: **[10]**

Radial load	= 3.2 kN
Journal diameter	= 50 mm
Bearing length	= 50 mm
Journal speed	= 1490 rpm
Radial clearance	= 50 microns
Viscosity of lubricant	= 25 cp
Density of lubricant	= 860 kg/m^3
Specific heat of lubricant	=1.76 kJ/kg^{0}C.

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate:

a) The minimum oil film thickness.
b) The coefficient of friction.
c) The power lost in friction.
d) The total flow rate of lubricant in *l*/min.
e) The side leakage.
f) The temperature rise.

OR

a) Write note on properties of bearing materials. **[05]**
b) Explain the significance of the following variables in connection with hydrodynamic bearings: **[05]**

i) l/d ratio **ii)** Unit bearing pressure
iii) Radial clearance **iv)** Minimum oil film thickness

Q.6 A pulley of 750 mm diameter is driven by an open flat belt from 20 kW to 720 rpm, electric motor. The pulley on motor shaft is of 400 mm diameter and center distance between the shafts is 2.5 m. The allowable tensile stress for belt material is 2 N/mm^2 while the coefficient of friction between belt and pulley is 0.3. The density of belt material is 900 kg/m^3. If width of belt is 100 mm, determine: **a)** The thickness of belt. **b)** The length of belt **c)** The initial tension required in belt. **[10]**

OR

a) Discuss stresses developed in wire ropes. **[05]**
b) Explain the procedure for the selection of V-belt from manufacturer's catalogue. **[05]**

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