B.TECH. SEM -VI MECHANICAL 2014 COURSE (CBCS) : SUMMER - 2018

SUBJECT : MACHINE DESIGN – II

Day : **Friday** Time : **02.30 PM TO 06.30 PM**

Date : **01/06/2018** **S-2018-2436** 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 What are the principles of Design for Manufacture and Assemblies (DFMA)? **[10]**

OR

What are the principles for design of welded assemblies? **[10]**

Q.2 It is required to design a pair of spur gear with 20^0 full depth involute teeth consisting of a 20 teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 22.5 kW, 1450 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe 410 (S_{ut} = 410 N/mm^2), while the gear is made of grey cast iron FG 200 (S_{ut} = 200 N/mm^2). The factor of safety is 1.5. Design the gears based on Lewis equation and using velocity factor to account for the dynamic load. **[10]**

OR

A spur gear pair with 20^0 full depth involute tooth profile consists of 18 teeth pinion meshing with 36 teeth gear. The pinion is connected to an electric motor running at 1440 rpm. The pinion and gear are made of steel with ultimate tensile strengths of 600 N/mm^2 and 510 N/mm^2 respectively. The module is 5 mm while the face width is 10 times of module. The surface hardness of pinion and gear are 330 BHN and 280 BHN respectively. If the required factor of safety is 2, calculate: **[10]**

a) The beam strength;
b) The wear strength;
c) The maximum static load the gear pair can transmit;
d) The rated power the gear pair can transmit.

Assume velocity factor, $Kv = \dfrac{5.6}{5.6 + \sqrt{V}}$ accounts for dynamic load.

Q.3 A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20^0, while the helix angle is 25^0. The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 (S_{ut} = 600 N/mm$^{2)}$ and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. **[10]**

OR

A pair of helical gears are to transmit 15 kW. The teeth are 20^0 stub in diametral plane and have a helix angle of 45^0. The pinion runs at 10,000 rpm and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given σ_{es} = 618 MPa. **[10]**

P.T.O.

Q.4 A single – row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The values of X and Y factors are 0.56 and 1.5 respectively. The shaft rotates at 1200 rpm. The diameter of the shafts is 75 mm and bearing number 6315 (C = 112000 N) is selected for this application. **[10]**

a) Estimate the life of this bearing, with 90 % reliability.

b) Estimate the reliability for 20000 hours life.

OR

Write short notes on: **[10]**

a) Mounting of Rolling Element Bearings

b) Preloading of Rolling Element Bearings

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

Radial load = 30 kN
Journal diameter = 75 mm
Bearing length = 75 mm
Journal speed = 3600 rpm
Radial clearance = 0.15 mm
Inlet temperature = 40^0C
The temperature viscosity relationship is as follows:

T^0C	40	41	42	43	44	45	46	47	48	49	50
Z (C_P)	52.5	50	47.5	45	43	41	39	37.5	36	34	33

Assume that the total heat produced in the bearing is carried by the total oil flow. The specific gravity and specific heat of the lubricant are 0.86 and 1.76 kJ/kg^{0}C respectively. Calculate the power lost in friction and the requirements of oil flow.

OR

a) Explain the mechanism of pressure development in oil-film of hydrodynamic journal bearings. **[05]**

b) Write a note on : Additive for mineral oils. **[05]**

Q.6 **a)** Explain the procedure for the selection of wire ropes from manufacturer's catalogue. **[05]**

b) Give the classification of chain. Explain polygonal effect of chain. **[05]**

OR

A fan running at 720 rpm is driven by an electric motor running at 1440 rpm through the 8 mm × 250 mm flat leather belt. The centre distance is 1370 mm. The coefficient of friction between the belt and pulley is 0.35 and the belt is 957 kg per cubic meter. If the allowable tensile stress for the belt material is 2.0 N/mm^2, determine: **[10]**

a) The maximum power transmitting capacity of the belt.

b) The diameters of the pulleys.

c) The required initial tension in the belt.

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