B.Tech. SEM -VI Mechanical 2014 Course (CBCS) : WINTER - 2018

SUBJECT: MACHINE DESIGN – II*

Day: Tuesday | **W-2018-2491** | Time: 10.00 AM TO 02.00 PM

Date: 13/11/2018 | Max Marks : 60

N.B. :

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

Q.1 Explain in brief the different casting processes. Also write note on the design of casting. **(10)**

OR

Q.1 Explain the design for manufacturing and assembly (DFMA). **(10)**

Q.2 Define 'Beam Strength' of spur gear in detail with Lewis equation. **(10)**

OR

Q.2 State and explain the different types of gear tooth failure, their causes and remedies. **(10)**

Q.3 A helical pinion having 21 teeth to be made of plain carbon steel 55C8, having permissible bending stress for pinion material is 240 N/mm^2 is to mesh with a gear to be made up of plain carbon steel 40C8 having permissible bending stress for gear material is 193.34 N/mm^2. The gear pair is required to transmit 10 KW power from an electric motor running at 1000 rpm to a machine running at 300 rpm. The starting torque of the motor is 125% of the rated torque. The factor of safety required is 1.25. The face width is 10 times the normal module and tooth system is 20^0 full depth involute. The helix angle is 25^0. The gears are to be machined to meet the specifications of grade 6. The gear and pinion are to be case hardened to 300BHN and 350 BHN respectively. Design the gear pair by using the velocity factor and Buckingham's equations for dynamic load. The deformation factor 'C' for gear pair is 11500 e N/mm. Take velocity factor **(10)**

$$kv = \frac{5.6}{5.6 + \sqrt{v}}$$

For grade 6 error in gear pair

$$e = 8 + 0.63\left[\text{mn} + 0.25\sqrt{d}\right]$$

Dynamic load

$$Fd = \frac{21\text{V}[\text{bc}\cos^2\varphi + \text{Ft max}]\cos\varphi}{21\text{V} + \sqrt{\text{bc}\cos^2\varphi + \text{Ft max}}}$$

OR

Q.3 A helical pinion having 14 teeth to be made of alloy steel having permissible bending stress 267 N/mm^2 is to mesh with a gear to be made up of plain carbon steel 55C8 having permissible bending stress for gear material is 240 n/mm^2. The gear pair is required to transmit 30 kw power, from an electric motor running at 720 rpm to a machine running at 225 rpm. The application factor and load concentration factor are 1.3 and 1.1 respectively the required factor of safety is 2 the face width is 10 times the normal module and tooth system is 20^0 full depth involute . The helix angle is 25^0. The gear are machined to meet the specification of grade 7. The deformation factor for gear pair is 11000 e N/mm. Design the gear pair by using the velocity factor and Buckingham's equations for dynamic load. Suggest the surface hardness for gear pair. **(10)**

P.T.O.

Take

$$1cv = \frac{5.6}{5.6+\sqrt{v}}$$

For grade 7

$$e = 11.0 + 0.9\left[\text{mn} + 0.25\sqrt{d}\right]$$

$$Fd = \frac{21\text{V}[\text{bc}\cos^2\varphi + \text{Ft max}]\cos\varphi}{21\text{V} + \sqrt{\text{bc}\cos^2\varphi + \text{Ft max}}}$$

Q.4 22 kw., 1440rpm. electric motor is directly coupled to a shaft of 25mm. diameter, which is supported by two cylindrical roller bearings. The shaft transmits power to another line shaft through the flat pulley of 250 mm. diameter which is placed midway between the two bearings. The coefficient of friction between the belt and pulley is 0.3 while angle of lap is 180^0. The belt is horizontal. The power load factor is 1.5 if the expected life of bearing is 50000 hrs select the bearing from manufacturer catalogues. Use following data: **(10)**

Bearing	Nu 2205	Nu 2305
Basic dynamic Capacity KN.	15.99	31.39

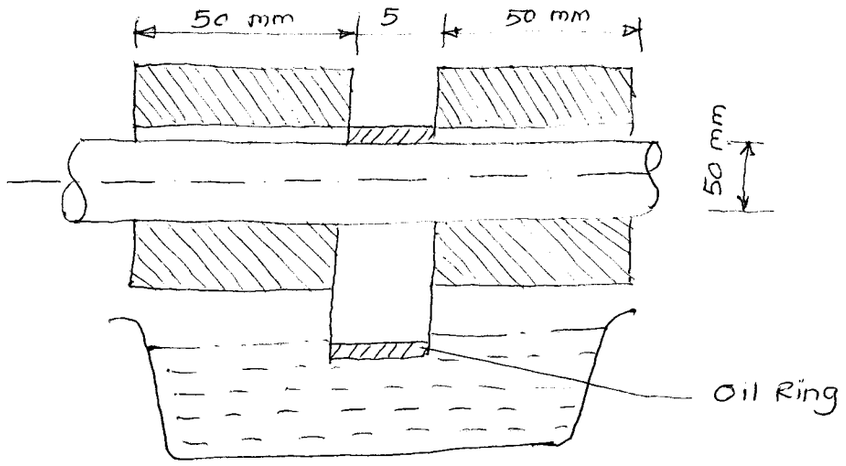
OR

Q.4 A single row deep groove ball bearing operated with the following work-cycle if the expected life of the bearing is 13000 hrs. with reliability of 90% calculate the dynamic load rating of the bearing and determine reliability of a system consisting of four such bearing. **(10)**

Expt. no	Element Time	Fr KN	Fa KN	Radial Factor	Thrust Factor	Race Rotating	Cs	Speed rpm
1	30%	5	1.5	0.56	1.1	Inner	1.25	960
2	40%	3.7	0.73	0.56	1.3	Outer	1.4	1440
3	50%	-	-	-	-	outer	-	720

Q.5 An oil ring type hydrodynamic bearing as shown in figure. The total radial load acting on the journal is 40 KN and journal rotates at 1470 r.p.m. The viscosity of the lubricant is 20 cP. If the radial clearance is 10 microns calculate: **(10)**

i) minimum oil film thickness and
ii) total flow rate of lubricant in liter per minute



$\frac{P\max}{p}$	l/d	ho/c	ϵ	S	$\frac{r}{c}f$	$\frac{Q}{r.c.ns.l}$	$\frac{Q_s}{Q}$
4.048	1	0.1	0.9	0.0188	1.05	4.74	0.919
3.195		0.2	0.8	0.0446	1.70	4.62	0.842
2.409		0.4	0.6	0.121	3.22	4.33	0.680
2.066		0.6	0.4	0.264	5.79	3.99	0.497
1.890		0.8	0.2	0.631	12.8	3.59	0.280

Q.5 **a)** Explain the mechanism of pressure development in oil film of hydrodynamic journal bearing. **(05)**

b) Draw radial and axial pressure distribution for hydrodynamic journal bearing. **(05)**

Q.6 Explain the procedure for selection of flat belt from manufactures catalogues. **(10)**

OR

Q.6 **a)** How wire ropes are designated and give its applications. **(05)**

b) Explain methods of lubrication of chain. **(05)**

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