

SUBJECT CODE NO:- P-211
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (MECH/PROD) Examination May/June 2017
Design of Machine Elements - II
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Attempt any three questions in each section.
 - ii) Assume suitable data if necessary.
 - iii) Use non-programmable calculator and design data book is allowed

Section A

Q.1 A gear drive is required to transmit a maximum power 20 KW. The pinion runs at 600 rpm and has the velocity ratio of 1.5. The center distance between the shafts is 650mm. The teeth has 20° stub involute profile. The static stress for cast iron gears may be taken as 80 MPA and face width as 10 times the module. Find out module, face width and number of teeth on each gear. Check the design for dynamic and wear loads considering the dynamic load factor in the Buckingham equation as 80 and the material combination factor for the wear as 1.4. Assume i) velocity factor $k_v = \frac{3}{3+v}$. ii) Tooth form factor.

$$Y = 0.175 - \frac{0.841}{t}$$

Q.2 Design a pair of bevel gear's to transmit 15 KW at 600rpm. Gear ratio is 2 and the pinion has 24 teeth of 20° involute full depth. The material for the pinion as well gear is the same with safe stress of 110 mpa and face width $b = \frac{l}{3}$ find the module, face width, cone distance and pitch circle diameter of the both gears. Assume $K_v = \frac{3.5}{3.5 + \sqrt{v}}$, where V= peripheral velocity in m/s. shaft angle is 90°. Check the design for wear strength and dynamic tooth load given that $S_{es} = 600\text{mpa}$, E_p & $E_g = 2 \times 10^5 \text{ mpa}$. C= dynamic load factor = 300KN/m and u' = tooth form factor = $0.154 - \frac{0.912}{T_f}$ and Velocity factor = $\frac{3}{3+v}$

- Q.3 A Explain epicyclic gear train. 03
 B A planetary gear is train consisting of spur gear is shown in fig 1. The sun gear 'A' rotates in clockwise 20 Kw 10 power at 1460 rpm to the gears train. The number of teeth on sun gear A. planet gear B and ring gear C are 20, 40 and 100 respectively. Calculate the torque that arm D can deliver to its output shaft.

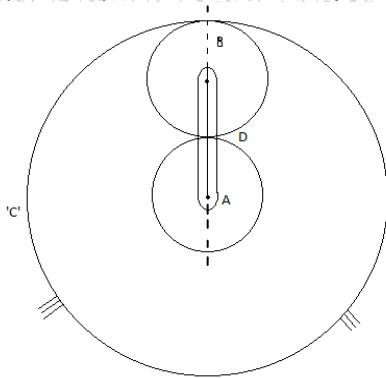


Fig 1.

Q.4 A cone clutch transmits 20 Kw, at 200 rpm. Following data are available $\mu = 0.25$ and maximum permissible intensity D_f pressure is 0.35 mpa. Semicone angle is 13°, outside diameter 260 mm, Using uniform wear theory calculate

- i. Face width of friction lining.
- ii. Operating force.

Q.5 Write short notes (any three)

14

- i. Compare between spur gear and helical gear.
- ii. Uniform pressure and used uniform theory of clutch.
- iii. Thermal consideration in clutch design.
- iv. Lewis equation for helical gear
- v. Gear material.

Section B

- Q.6 A Explain hydrostatic bearing. 03
 B In a journal bearing of 100mm diameter with a bearing clearance of 0.1 mm, it is found suitable to use lubricating oil with viscosity 60 cp (centipoise). The shaft runs at 500 rpm and develop a bearing pressure of 1.5 N/mm². Determine: - i) bearing pressure when the shaft speed is increased to 600 Rpm, other parameter remaining same. ii) Viscosity at 0.15mm bearing clearance, 450 rpm of shaft and 2.0 N/mm² bearing pressure. 10
- Q.7 A Compare between rolling contact bearing and sliding contact bearing 03
 B A deep groove ball bearing has a dynamic capacity 25,000N and is to operate on following work cycle of different radial loads. 10
 5800N at 200 rpm for 25% of time, 8900N at 500 rpm for 35% of time & 4000N at 400 rpm for remaining time. Assume that the loads are steady and that the inner race rotates. Find the average life of bearing in hours.
- Q.8 Two shafts 1.2m apart are connected by a belt drive. 120 kW power is to be transmitted at 1440 rpm of driver pulley which is of 300 mm diameter. The speed ratio is there. The angle of groove on the pulley is 30°. Area of cross section of belt is 450mm and permissible stress is 2.5 mpa. Density of belt material is 1000 kg/m³ and $\mu=0.25$. Find the no. of belts required and length of belt. 13
- Q.9 A What is self locking in brake? 03
 B A differential band brake as shown in fig.2 has an angle of contact of 220°. The band has a compressed woven lining and bears against a cast iron drum of 350mm diameter. This is sustains a torque of 350Nm and the coefficient of friction between the band and the drum is 0.3. Find 10
- i. The necessary force (p) for the clockwise and anticlockwise rotation of the drum.
 - ii. The value of "OA" for the brake to be self locking when the drum rotates clockwise.

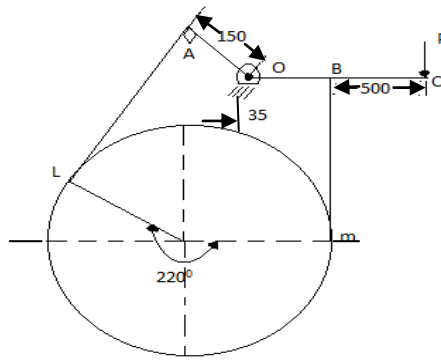


Fig.2

- Q.10 Write short on (Any three) 14
- a. Types of belts
 - b. Long shoe and short brake
 - c. Variable loading in bearing
 - d. Compares between belt drive and gear drive
 - e. Sommerfield number