

CODE NO:- K-3
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (MECH/PROD) Examination Nov/Dec 2015
Design of Machine Elements - II
(Revised)

[Time: Three Hours]

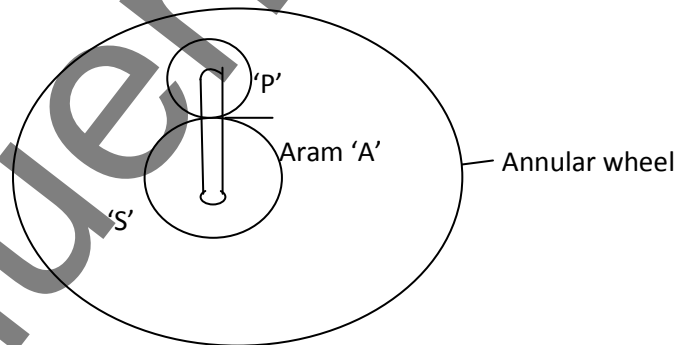
[Max. Marks: 80]

“Please check whether you have got the right question paper.”

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

SECTION-A

- Q.1 It is required to design a spur gear with 20° full depths in involute teeth based on Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 12KW, 1450rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4:2. The pinion as well as the gear is made of plain carbon steel 40C8 ($6ut\ 600N/mm^2$). The factor of safety can be taken as 1.5. Design the gears and specify their dimensions and suggest surface hardness for the gears. 14
- Q.2 A pair of helical gears used to transmit 7KW at 1440rpm of pinion with 20° in involute stub teeth. The pressure angle is 30° gear ratio 4. Centre distance is 200mm material for both pinion and gear is steel having static strength of $300MN/m^2$ and hardness of 200BHN. Factor of safety is 3. Design the gear. Check the design for dynamic load and wear load. $C=119KN/m$. $Kv = \frac{5.6}{5.6+\sqrt{v}}$ 13
- Q.3 A Explain epicyclic gear train. 03
 B An epicyclic gear train consist of a sun wheel of 50 teeth. A planet pinion and annular wheel with 110 teeth (internal) concentric with sun wheel. The planet pinion meshes with sun wheel and annular wheel. The arm that carries the axis of the pinion rotates at 150rpm. Calculate the speed of the annular wheel if the sun wheel is fixed and the speed of the sun wheel if the annular wheel is fixed. 10



- Q.4 A cone clutch is to be designed to transmit 8kw at 100rpm. Assuming the normal pressure between the contact surfaces not to exceed $0.1N/mm^2$ coefficient of friction between contact surface as 0.2 and cone angle to be 24° . Design the main dimension of the clutch. Also calculate the axial force require to engage the clutch. Take the width of the face to be half the mean radius. 13
- Q.5 Write short notes on (any three) 13
- i) Gear material for worm and worm wheel speed reducer.
 - ii) Advantages of helical gear over spur gear
 - iii) Thermal consideration in worm gear.
 - iv) Classification of clutch. Explain one in detail.

SECTION-B

- Q.6 A Explain hydrostatic bearing. 04
- B A 50mm diameter journal bearing $N=1500\text{rpm}$, $L/d=1$, $c=0.05\text{mm}$, $h_o=0.01\text{mm}$. Calculate maximum radial load that the journal bearing can carry and still operate under hydrodynamic conditions. For this load calculate the power lost in friction and temperature rise of lubricating oil for the following data: 10
- i) Absolute viscosity of oil $=20 \times 10^{-3} \text{ pas}$
 - ii) Specific heat of lubricating oil $=2.1 \text{ KJ}/109^\circ\text{C}$.
- Q.7 A deep groove bearing with inner race rotation has 60sec. work cycle as follows. 13
- For 15sec $F_r=3550\text{N}$ $F_a=1785\text{N}$, $N=950\text{rev}$.
For 45sec $F_r=2700\text{N}$, $F_a=0$, $N=1250\text{rev}$.
- The static and dynamic load rating of bearing $C_o=16225\text{N}$ and $C=22825\text{N}$. Find rating life the bearing in years 300 days each for 10 hrs a day operations.
- Q.8 A V belt drive transmits 12KW at 1000rpm of the smaller pulley. The pitch diameters are 125 mm and 350mm. if the maximum force per belt is 600N. Determine the no of belts required. If the coefficient of friction is 0.2 and the groove angle of the pulley is 34. The belt mass is 200 gram/meter. 13
- Q.9 In a band and block brake, the band is lined with 16 blocks, each subtending an angle of 15° at the centre. Find out the least force required for the brake to absorb 225 kW at 150rpm. Take $\mu=0.35$ lengths of pins on either side of fulcrum=150mm and 30mm respectively and length of lower 600mm. consider brake drum diameter as 800mm and thickness of each block as 70mm. 13
- Q.10 Write short notes on (any three) 13
- i) Compare between hydrostatic bearing and hydrodynamic bearing
 - ii) Properties of sliding contact bearing
 - iii) Statical consideration in design
 - iv) Creep of belt
 - v) Rope drive.