CBCS SCHEME

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15ME64

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of design data hand book is permitted.*
3. *Missing data can be suitable assumed.*

Module-1

1 a. List differences between curved and straight beam. **(04 Marks)**

b. A chain link is made of 16 mm diameter steel rod. The mean radius of the semicircular end is 50 mm and the length of the straight portion of the link is 80 mm. Determine the maximum tensile and compressive stress when the link is subjected to a pull of 5 KN. **(12 Marks)**

OR

2 a. The following data refers a diesel engine:
Inside cylinder diameter = 150 mm, Explosion pressure = 5 N/mm^2; Material for the cylinder and head = Grey CI FG150; Factor of safety = 5
Design (i) Cylinder (ii) Head. **(05 Marks)**

b. A cast iron cylindrical pipe of outside diameter 300 mm and inside diameter 200 mm is subjected to an internal fluid pressure of 20 N/mm^2 and external pressure of 5 N/mm^2. Determine the tangential and radial stresses at the inner and outer surface. Also sketch the tangential stress and radial stress distribution across its thickness. **(11 Marks)**

Module-2

3 a. Explain concept of slip and creep in belt drive. **(04 Marks)**

b. Select a V-belt to transmit 10 kW of power from a pulley of 200 mm diameter mounted on an electric motor running at 720 rpm to another pulley mounted on compressor running at 200 rpm. The service is heavy duty varying from 10 Hrs to 14 Hrs per day and centre distance between centre of pulleys is 600 mm. **(12 Marks)**

OR

4 a. In a block and tackle mechanism, 3 pulleys at the top and 2 pulleys at the bottom block. Derive an expression for the effort required to raise the load in terms of load to be lift and pulley co-efficient. **(05 Marks)**

b. Explain any two types of chain used for power transmission. **(03 Marks)**

c. A loaded narrow gauge car weighs 18 KN and moving at velocity of 80 m/min is brought to rest by a buffer consists of two helical springs. In bringing the car to rest the spring undergoes a compression of 200 mm. The allowable shear stress is 0.3 GPa and the spring index is 8. Design a suitable spring. Take modulus of rigidity 84 GPa. **(08 Marks)**

Module-3

5 a. Give a detailed classification of gears. **(04 Marks)**

b. Design a pair of spur gears to transmit a power of 20 kW from a shaft at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume number of teeth on pinion 31 and 20° full depth involute tooth form. The material for pinion is C40 steel interated and for gear cast steel 0.20% C untreated. **(12 Marks)**

OR

6 a. Derive an equation for beam strength of helical gear. **(04 Marks)**

b. A pair of mitre gears has pitch diameter 280 mm and face width of 36 mm and runs at 250 rpm. The teeth are $14\frac{1}{2}^{\circ}$ involute profile and accurately cut and transmit 6 kW. Neglect friction angle, find the following:

(i) Outside diameter of gears.
(ii) Resultant tooth load tangent to pitch cone.
(iii) Radial load on the pinion.
(iv) Thrust on the pinion. **(12 Marks)**

Module-4

7 a. Complete the design and determine the input capacity of the worm gear speed reducer unit which consists of a hardened steel worm and a phosphor bronze gear having 20° stub involute teeth. The centre distance is 200 mm, transmission ratio is 10 and worm speed is 2000 rpm. **(12 Marks)**

b. Design a single plate clutch consists of two pairs of contacting surfaces for a torque capacity of 200 N-m. Due to space limitations the outside diameter of the clutch is to be 250 mm. **(04 Marks)**

OR

8 a. List friction materials used in clutch. Also derive an expression for torque transmitted by plate clutch. Assume uniform wear theory. **(06 Marks)**

b. A differential band brake has an operating lever 225 mm long. The ends of the brake band are attached so that their operating arms are 38 mm and 127 mm long. Brake drum diameter is 600 mm, Arc of contact is 300° and co-efficient of friction is 0.22. The band is 3.2 mm × 100mm .

(i) Find the least force required at the end of operating lever when the band is subjected to a stress of 55 N/mm^2.
(ii) What is the torque applied to the brake drum shaft?
(iii) Is this brake self locking? Proove your answer. **(10 Marks)**

Module-5

9 a. Derive Petroff's equation for a lightly loaded bearing. **(05 Marks)**

b. Design the main bearing of a steam turbine that runs at 1800 rpm. The load on the bearing is estimated to be 2500 N. Assume SAE 20 grade oil. **(11 Marks)**

OR

10 a. List and explain types of roller bearings. **(06 Marks)**

b. Derive an expression for reliability of a bearing. **(04 Marks)**

c. The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is 720 rpm. The bearings are to have 99% reliability corresponding to a life of 24000 Hrs. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacture's catalogue, specified at 90% reliability. **(06 Marks)**

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