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RM-6431

B. E. - II (Sem. IV) (Chem.) Examination

May / June – 2010

Theory of Machine & Machine Design

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 2 (Sem. 4) (Chem.)**

Name of the Subject :

☛ **Theory of Machine & Machine Design**

☛Subject Code No. : **6 4 3 1** ☛Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Q.1 and Q.5 are **compulsory**.

(3) Attempt any 2 questions from Q2, Q3 and Q4 in section I and Q.6, Q.7 and Q.8 for Section II.

(4) Use of drawing sheets, scientific calculator and design data book (IS-4460 (1967)) is permitted.

(5) Assume data if necessary.

SECTION - I

1 (a) (i) Make neat sketches for types of cams and followers. **14**

(ii) Explain the pressure angle in cam.

(iii) What is kinematic link? Give its types.

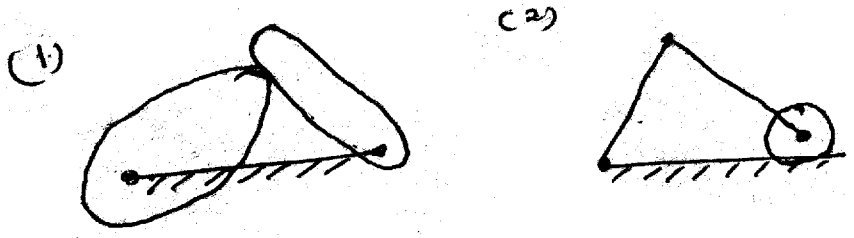
(iv) What is the use of cam and follower?

(v) Give examples where friction is useful and harmful.

(vi) What is interferance in gear?

(vii) Explain 'theory of machine'.

(b) Find degree of freedom for the following : **6**



2 Draw the cam profile for knife-edge follower.

(i) Outstroke during 50° cam rotation.

(ii) Return stroke for 80° cam rotation.

(iii) Two equal dwells.

(iv) Lift 50 mm

(v) Minimum cam diameter is 100 mm.

(vi) Follower moves with SHM for both the strokes.

(vii) The axis of follower is offset by 20 from cam axis.

(a) Draw diaplacement diagram. **5**

(b) Draw profile. **10**

3 (a) Define following for toothed gearing. **8**

(i) Pitch circle

(ii) Addendum

(iii) Module

(iv) Clearance.

(b) The number of teeth on each of the two equal spur gears in mesh are 40, the teeth have 20° involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum. **7**

4 (a) State laws of **6**

(i) Solid friction

(ii) Fluid friction

(b) The mean diameter of a square threaded screw jack is 50 mm. The pitch of the thread is 10 mm. The μ is 0.15. What force must be applied at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and to lower it ? **9**

SECTION - II

5 (a) Answer the following : **10**

(i) Define : Factor of safety.

(ii) The centre to centre distance between two consecutive rivets in a row is known as _____.

(iii) Define welded joint.

(iv) In a steam engine, the piston rod is connected to the crosshead by _____ joint.

(v) classify keys.

(vi) Write the material used for Belt.

(vii) Define Addendum.

(viii) Define : Helix angle

(ix) In helical gears, the right hand helices on one gear will mesh _____ helices on the other gear.

(x) A bolt of M 22 × 2 means _____.

(b) Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6.

6 (a) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor is 1.35. The following permissible stresses is used :

Shear stress for shaft, bolt and key material = 40 MPa.

Crushing stress for bolt and key = 80 MPa

Shear stress for cast iron = 8 MPa.

(b) Write the selection criteria for factor of safety. **5**

7 (a) Two paralled shaft whose centre lines are 4.8 m apart are connected by an open belt drive. The diameter of the larger pulley is 1.5 m and smaller pulley 1 m. The initial tension in belt when stationary is 3 kN. The mass of belt is 1.5 kg/m length. The coefficient of friction between the belt and pulley is 0.3. Taking centrifugal tension into account. Calculate the power transmitted, when smaller pulley rotates at 400 rpm. **7**

(b) A bracket is riveted to a column by 6 rivets of equal size as shown in **Fig. 1** it carries a load of 60 kN at a distance of 200 mm from the centre of column if the maximum shear stress in the rivet is limited to 150 MPa. Determine the diameter of rivet. 8

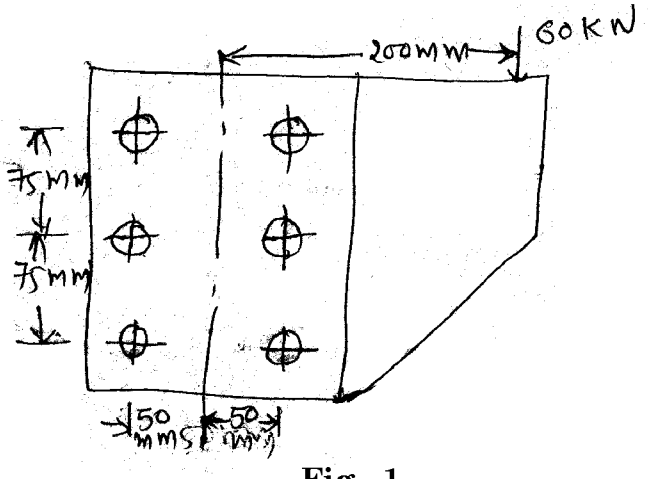


Fig. 1

8 (a) Design a shaft to transmit power from an electric motor to a lathe head stock through pulley by means of belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of bearing. The diameter of pulley is 200 mm and maximum power transmitted is 1 kW at 120 rpm. The angle of lap of belt is 180° and coefficient of friction between the belt and pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2 respectively the allowable shear stress in shaft is 35 MPa. 7

(b) A pair of straight teeth spur gear is to transmit 20 kW when the pinion rotates at 300 rpm. The velocity ratio is 1:3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine : (i) module (ii) face width.

The tooth form factor $Y = 0.154 - \frac{0.912}{\text{No. of teeth}}$ and

Velocity factor $C_V = \frac{3}{3+v}$ where v is in m/sec.