BACHELOR OF POWER ENGG. EXAMINATION, 2010

(2nd Year, 2nd Semester)

THEORY OF MACHINES & MACHINE DESIGN

Time : Three hours. Full Marks : 100

Answer question no. ***1*** and any ***two***
each from following two sections.

Section 1.

1. a) Write the steps to be followed by a designer in Machine Design. 4

   b) Define Degrees of Freedom and explain Gruebler's Equation 7

   c) What are preferred numbers? 3

   d) Define a gear train with sketch. Write the relation between velocity ratio and gear ratio. 6

Sction 2.

Answer any ***two*** questions :

2. a) Illustrate with sketches one higher pair and one lower pair. 6

   b) What are the similarities and one difference between a machine and a mechanism. 2

   c) Draw an inclined plane and mention the Mechanical

advantage and Efficiency. 5

d) What are the advantages of a belt drive? 3

e) Name some of the common flat belt materials. 2

f) What is meant by A 3012/118. In case of a V – belt? 2

3. a) Define the following terms Crank, Rocker, Crank - rocker mechanism, Double-crank mechanism, Double-rocker mechanism.

2+2+3+3+3

b) In the table below for a four bar linkage mechanism, replace * with =, <, > or their combination,

Here s = length of shortest bar, l = length of longest bar, p, q = lengths of intermediate bar 7

Case	l + s vers, p+q	Shortest Bar	Type
1	*	Frame	Double-crank
2	*	Side	Rocker-crank
3	*	Coupler	Double rocker
4	*	Any	Change point
5	*	Any	Double-rocker

4. a) As shown in following figure, the displacement diagram of the follower is given, s = s (ϕ). Construct the plate cam profile using a reciprocating knife-edge follower. 14

b) What is the curvature effect in a helical spring?

How does it vary with spring index? 5

c) What do you understand by shaft, axle and spindle? 3

d) Write the following sections of V-belts in descending order of strength – A, E,C 2

e) Two plates of 7mm thickness are connected by a double riveted lap joint of zigzag pattern. Calculate rivet diameter, rivet pitch and distance between rows of rivets for the joint. Assume ultimate tensile stress = 90MPa, ultimate shear = 60MPa and ultimate bearing stress = 120 MPa. 8

8. a) Derive the equation for Braking Torque in an internal expanding shoe brake. 12

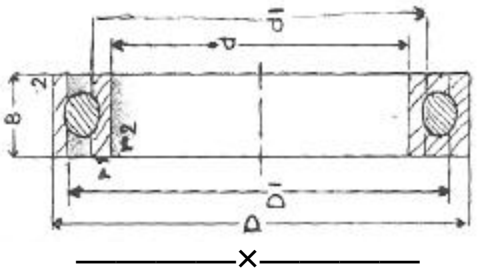
b) What is the recommended center distance and belt speed for a flat belt drive? 3

c) Draw Welding Symbol with proper labels. 5

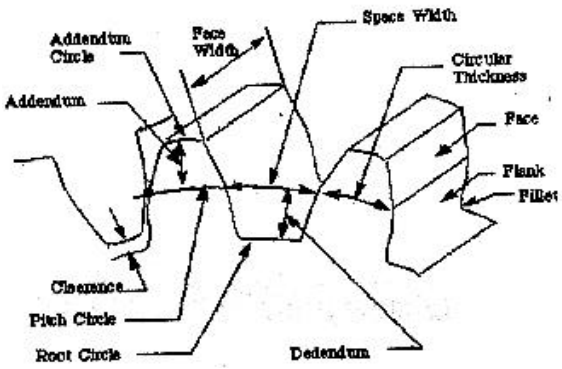
9. a) Two plates 200 mm wide and 10 mm thick are to be welded by means of transverse welds at the ends,. If the plates are subjected to a load of kN, find the size of the weld assuming the allowable tensile stress 70 MPa. 10

b) Why the slack side of the belt of a horizontal belt drive is preferable to place on the top side? 5

c) Label different terms of the bearing shown below. 5



5. a) Define all labeled terms and their relations. 12



b) Explain Geneva wheel mechanism with a neat sketch. 8

Section 3

Answer any ***two*** questions

6. a) In a steam engine the steam pressure is 2 MPa and the cylinder diameter is 250 mm. The contact surfaces of the head and cylinder are ground and no packing is required. Choose a suitable bolt so that the joint is leak proof. Assume number of bolts to be used is 12. 10

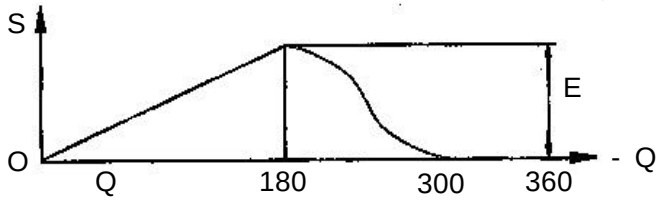
b) A single square thread power screw is to raise a load of 50 KN. 10

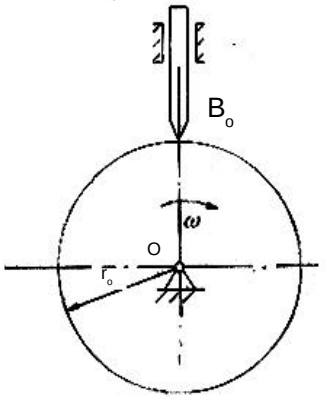
A screw thread of major diameter of 34 mm and a pitch of 6 mm is used. The coefficient of friction at the thread and collar are 0.15 and 0.1 respectively. If the collar frictional diameter is 100mm and the screw turns at a speed of 1 revs $^{-1}$ find

i) the power input to the screw.

ii) the combined efficiency of the screw and collar.

7. a) How are plain carbon steel designated? 2





b) Name the following mechanism and explain it's working principle. 6