



**T.E. (Mechanical) (Sem. – I) Examination, 2010**  
**THEORY OF MACHINES AND MECHANISMS – II**  
**(2003 Course)**

Time : 3 Hours

Max. Marks : 100

**Instructions :** 1) Answer **three** questions from Section I and **three** questions from Section – II.

2) Answers to the **two** Sections should be written in separate books.

3) Neat diagrams must be drawn **wherever** necessary.

4) Black figures to the **right** indicate **full** marks.

5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.

6) Assume suitable data, **if** necessary.

**SECTION – I**

**UNIT – I**

1. a) Explain the following terms :

- i) Crowning of pulley
- ii) Initial tension in belt
- iii) Creep in the belt.

6

b) A V-belt of  $6.0 \text{ cm}^2$  cross-section has a groove angle of  $40^\circ$  and an angle of lap of  $150^\circ$ ,  $\mu = 0.1$ . The mass of belt per meter run is  $1.2 \text{ kg}$ . The maximum allowable stress in the belt is  $850 \text{ N/cm}^2$ . Calculate the power that can be transmitted at a belt speed of  $30 \text{ m/s}$ .

10

**OR**

2. a) Find expression for the screw efficiency at a square thread. Also determine the condition for maximum efficiency.

6

b) Explain the terms :

6

- i) Friction circle
- ii) Friction couple
- iii) Friction axis

c) Explain friction in a four-bar mechanism.

4



## UNIT – II

3. a) What is meant by wet clutch and dry clutch ? Where are they used ? 4
- b) Derive the expression for the torque transmitted for flat callar bearing assuming uniform pressure theory. 4
- c) A conical clutch has a cone angle of  $30^\circ$ . If the maximum intensity of pressure between the contact surfaces is limited to 70 kPa and the breadth of the conical surface is not to exceed  $1/3^{\text{rd}}$  of the mean radius. Find the dimensions of the contact surfaces to transmit 22 kW at 2000 rpm. Assuming uniform wear and take coefficient of friction as 0.15. 8

OR

4. a) Explain the functions of brake and dynamometer. 4
- b) Explain self-locking or self energising of brake. 4
- c) Explain with the help of neat sketch any one type of absorption dynamometer. 8

## UNIT – III

5. The roller following a cam moves with SHM during ascent and with uniformly accelerated and deaccelerated motion during descent. The cam rotates at 370 rpm. Draw the cam profile for the following data :

Least radius of cam = 60 mm

Angle of ascent =  $54^\circ$ 

Angle of dwell between

ascent and descent =  $48^\circ$ Angle of descent =  $66^\circ$ 

Life of the follower = 50 mm

Roller diameter = 30 mm

Offset of follower axis = 20 mm towards right. Determine the maximum velocity and acceleration of follower during ascent and descent. 18

OR

6. a) With the help of neat sketches explain the types of cam and followers. 6
- b) Derive an expression for displacement, velocity and acceleration of a tangent cam with roller follower
- when i) roller is in contact with flank
- ii) roller is in contact with nose. 12



## SECTION – II

## UNIT – IV

7. a) Define the term 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed.' 4
- b) Prove that the maximum fluctuation of energy,  $\Delta E = E \times 2C_s$ , where  $E$  = mean kinetic energy of the flywheel and  $C_s$  = coefficient of fluctuation of speed. 6
- c) The flywheel of a steam engine has a radius of gyration of 1m and mass 250 kg. The starting torque of the steam engine is 1500 N-m and may be assumed constant. Determine :
- i) The angular acceleration of the flywheel
- ii) The kinetic energy of the flywheel after 10 sec. from the start. 6

OR

8. a) Explain the term height of the governor. Derive an expression for the height in the case of Watt Governor. What are the limitations of Watt Governor ? 6
- b) Explain the term 'Hunting' in case of governor. 2
- c) What is stability of governor ? Sketch the controlling force verses radius diagrams for a stable, unstable and isochronous governor. Derive the conditions for stability. 8

## UNIT – V

9. a) Compare the cycloidal and involute tooth forms. 4
- b) Two  $20^\circ$  involute spur gears have a module of 10 mm. The addendum is equal to 1 module. The larger gear has 40 teeth while the pinion has 20 teeth. Will the gear interfere with the pinion ? 6
- c) The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have  $20^\circ$  involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum. 6

OR

10. a) Derive the velocity ratio and centre distance of helical gears with the help of sketch. 6
- b) Discuss various types of forces acting on helical gears and its efficiency. 6
- c) Two left-handed helical gears connect two shafts  $60^\circ$  apart. The normal module is 6mm. The larger gear has 70 teeth and the velocity ratio is 1/2. The centre distance is 370 mm. Find the helix angles of the two gears. 4



## UNIT - VI

11. a) Derive an expression for the centre distance of a pair of spiral gears. 6  
 b) Define the term worm and worm wheel. 4  
 c) Show that, in a pair of spiral gears connecting inclined shafts, the efficiency is maximum when the spiral angle of the driving wheel is half the sum of the shaft and friction angle. 8
- OR
12. a) Explain briefly the difference between simple compound and epicyclic gear trains. What are the special advantages of epicyclic gear train. 8  
 b) In an Epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of gear A which is fixed, determine the speed of gear B. If the gear A is instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B ? Sketch the arrangement. 10

B/II/10/1,685