[3763] – 113

T.E. (Mech.) (Semester – I) Examination, 2010
THEORY OF MACHINES AND MECHANISMS – II
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer **3** questions from Section **I** and **3** 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

1. a) Define the following terms related with friction :

i) Friction circle

ii) Wedge

iii) Coefficient of friction

iv) Film friction

v) Slip in belt

vi) Law of belting. **6**

P.T.O.

b) The cutting speed of a broaching machine is 9 meter/minute. The cutter of the machine is pulled by a square threaded screw of 60 mm nominal diameter and 12 mm pitch. The operating nut takes an axial load of 500 N on a flat surface of 80 mm external diameter and 48 mm internal diameter.

Determine the power required to rotate the operating nut.

Take $\mu = 0.14$ for all contact surfaces on the nut. **10**

OR

2. a) Derive the relation for ratio of belt tensions in a flat belt drive. **6**

b) A belt drive is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 gm/mm^3. Safe stress in the belt is not to exceed 2.5 N/mm^2. Diameter of driving pulley is 250 mm, whereas the speed of the driven pulley is 220 rpm. The 2 shafts are 1.25 m apart. The coefficient of friction is 0.25.

Determine the width of belt. **10**

3. a) Explain the working of multiple clutch, with the help of neat diagram. **6**

b) A friction clutch is used to rotate a machine from a shaft rotating at a uniform speed of 250 rpm. The disc type clutch has both of its sides effective, the coefficient of friction being 0.3. The outer and inner diameters of friction plate are 200 mm and 120 mm respectively.

Assuming uniform wear of clutch, the intensity of pressure is not to be more than 100 KN/m^2. If the moment of inertia of the rotating parts of the machine is 6.5 kg.m^2, determine the time to attain the full speed by the machine and the energy lost in slipping of the clutch. **10**

OR

4. a) Explain with neat diagram the belt transmission dynamometer. **8**

   b) A bicycle and rider, travelling at 12 km/hr on a level road, have a mass of 105 kg. A brake is applied to the rear wheel, which is 800 mm in diameter. The pressure force on the brake is 80 N and the coefficient of friction is 0.06.

   Find the distance covered by the bicycle and the number of turns of its wheel before coming to rest. **8**

5. a) Explain jump phenomenon of cam. **4**

   b) The following data relate to a cam profile in which the follower moves with uniform acceleration and deacceleration during ascent and descent.

   Minimum radius of cam = 25 mm

   Roller diameter = 7.5 mm

   Lift = 28 mm

   Offset of follower axis = 12 mm towards right

   Angle of ascent = 60°

   Angle of descent = 90°

   Angle of dwell between ascent and descent = 45°

   Speed of cam = 200 rpm

   Draw the profile of the cam and determine the maximum velocity and the uniform acceleration of the follower during the outstroke and the return stroke. **14**

OR

6. a) Define the following terms related with cam and follower :

   i) Prime circle

   ii) Trace point

   iii) Pitch curve

   iv) Pressure angle

   v) Base circle

   vi) Specified contour cam. **6**

   b) A tangent cam with straight working faces tangential to a base circle of 120 mm diameter has a roller follower of 48 mm diameter. The line of stroke of the roller follower passes through the axis of the cam. The nose circle radius of the cam is 12 mm and the angle between the tangential faces of the cam 90°. If the speed of the cam is 180 rpm, determine the acceleration of the follower, when

   i) during the lift, the roller just leaves the straight flank.

   ii) the roller is at the outer end of its lift, i.e. at the top of the nose. **12**

SECTION – II

7. a) Compare flywheel and Governor. **4**

   b) Explain the T-θ diagram for multi-cylinder four stroke I.C. engine. **6**

   c) The cycle of operations performed by a machine extends over 3 revolutions. The torque required is constant 400 N-M for one revolution, zero for the next revolution, 550 N-M for the first half of third revolution and zero for the rest

of the cycle. Flywheel has a mass of 500 kg at a radius of gyration of 0.5 m. If the driving torque is constant and the mean speed is 180 rpm,

Calculate : a) Power required

b) % Fluctuation of speed

c) The greatest acceleration and retardation. **8**

OR

8. a) Explain the principle of Inertia Governors. **4**

b) In an engine governor of the porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg and the mass of each flyball is 2kg. The friction at the sleeve is equivalent of 24 N load. If the limiting inclinations of the upper arms to the vertical are 30° and 40°, find range of speed of the governor taking into account friction. **7**

c) In a spring loaded Hartnell type governor, the extreme radii of rotation of the flyballs are 80 mm and 120 mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 rpm and 420 rpm, find :

1) The initial compression of the central spring.

2) Spring constant. **7**

9. a) Justify conjugate action in involute gears. **6**

b) Two mating gears with module of 6.5 mm have 19 and 47 teeth of 20° pressure angle and standard addenda.

Determine :

i) The number of pairs of teeth in contact

ii) Angle turned by pinion and wheel

iii) Maximum velocity of sliding.

Pinion rotates at 1000 rpm. **10**

OR

10. a) Explain the meaning of following terms with neat sketches :

i) Helix angle

ii) Transverse pitch

iii) Normal pressure angle

iv) Normal pitch. **8**

b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 40 teeth gear. The helix angle is 25° and the normal pressure angle is 20°. The normal module is 3 mm.

Calculate :

i) Transverse module

ii) Transverse pressure angle

iii) Axial pitch

iv) Pitch circle diameters of the pinion and gear. **8**

11. a) Two horizontal shafts are connected by a pair of spiral gears A and B. The angle between the shafts is 60°. A is the driver and rotates 1.5 times B. A has 40 teeth and helix angle of 25°. The normal pitch is 10 mm. The torque applied at A is 30 N-m. Find :

i) the pitch circle diameters

ii) the end thrust on each shaft.

Normal pressure angle is 20°. **8**

b) Derive an expression for efficiency of worm and worm gears when worm is driver. **8**

OR

12. a) Define the following terms related to bevel gears :

i) Pitch cone angle

ii) Back cone angle

iii) Shaft angle

iv) Face width. **4**

b) Explain with application a reverted gear train. **4**

c) In a reverted epicyclic train, the arm F carries two wheels A and D and a compound wheel B-C. The wheel A meshes with wheel B and the wheel D meshes with wheel C. The number of teeth on wheel A, D and C are 80, 48 and 72 respectively.If arm makes 200 rpm and wheel A is fixed, find the speed and direction of wheel D. **8**
