Total No. of Questions :12]

SEAT No. :

P1598

[Total No. of Pages :5

[5058] - 14

T.E. (Mechanical & Auto)

THEORY OF MACHINES - II

(2008 Pattern) (Semester - I)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Answer three questions from Section I and three questions from Section II.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables, slide rule, electronic pocket Calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain the following terms: **[9]**

i) Virtual coefficient of friction.

ii) Angle of repose.

iii) Angle of friction.

iv) Friction circle.

b) A centrifugal clutch transmits 10kW power at 900 rpm. The shoes are four in number. The speed at which shoes engages with the drum is 75% of running speed. The inner radius of drum is 15 cm and the radial distance of center of gravity of shoe from axis of rotation of the spider in the engaged position is 12 cm. If the coefficient of friction is 0.25 and maximum permissible pressure intensity of is 0.1 N/mm^2 . Determine the mass of each shoe. **[9]**

OR

Q2) a) Derive an expression for tension ratio in case of band and block brake with the help of necessary sketch. **[9]**

P.T.O.

b) A simple band brake is applied to a shaft carrying a flywheel of mass 250 kg and radius of gyration 350 mm. The shaft speed is 200 rpm. The drum diameter is 200mm & coefficient of friction is 0.25. The free end of band is attached at 100 mm from fulcrum and effort of 120 N is applied on lever at 280 mm from fulcrum. The angle of embraced by belt is 225°. Determine for counter clockwise rotation of drum. **[9]**

i) Braking Torque.

ii) The number of turns of flywheel before it comes to rest.

iii) The time taken by flywheel to come to rest.

Q3) A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below: **[16]**

a) To raise the valve through 50 mm during 120° rotation of the cam;

b) To keep the valve fully raised through next 30°;

c) To lower the valve during next 60°; and

d) To keep the valve closed during rest of the revolution i.e. 150°;

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm.

Draw the profile of the cam when the line of the stroke is offset 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m.

OR

Q4) a) Explain the jump phenomenon in cam system. Derive the expression for minimum speed of cam to avoid jump. **[8]**

b) The following data relates to symmetrical circular arc cam operating a flat faced follower. **[8]**

Least radius of cam is 30mm, total lift is 12.5 mm, angle of lift is 55°, nose radius = 3mm, speed of cam = 600 rpm.

Find: Distance between cam center and nose radius.

Radius of circular flank.

Q5) a) Determine condition of stability of two wheel vehicle moving in a curved Path. **[8]**

b) An aero plane makes a complete half circle of 50m radius, towards left when flying at 200 km/hr. The rotating engine and the propeller of the plane have a mass 400 kg with a radius of gyration of 40 cm. The engine runs at 2400 rpm clockwise when viewed from rear. Find gyroscopic couple on the plane and state its effect on it. **[8]**

OR

Q6) a) Explain following terms of Governor. **[8]**

i) Sensitiveness.

ii) Insensitiveness

iii) Stability.

iv) Isochronism.

b) A Hartnell governor having a central sleeve spring and two right- angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. **[8]**

Determine:

i) Loads on the spring at the lowest and the highest equilibrium speeds,

ii) Stiffness of the spring.

SECTION - II

Q7) a) Derive an expression for minimum number of teeth on a gear wheel when it is in mesh with a pinion for Involute tooth profile. **[6]**

b) Two 20° involute gears in mesh have a gear ratio of 2 and 20 teeth on the pinion. The module is 10 mm and the speed of pinion is 250 rpm. If the addendum of each is such that the path of approach and path of recess on each side are half of the maximum possible length each, find **[12]**

i) The addendum of pinion and gear.

ii) The length of contact.

iii) The maximum velocity of sliding during approach and recess.

OR

Q8) a) What do you mean by interference and undercutting? **[6]**

b) Prove that the change in center distance within limits of involute gears will not affect the velocity ratio. **[4]**

c) Two 20° pressure angle involute gears in mesh have a module of 10 mm. The addendum is one module. The gear and the pinion have 50 and 13 teeth's respectively. **[8]**

i) Does interference occur?

ii) If it occurs, to what value should be the pressure angle changed to avoid interference?

Q9) a) Two Helical gears having speed reduction of 3:1 and normal module 6mm with normal pressure angle 20° and helix angle 30°. If the center distance is approximately 600mm apart, determine the number of teeth on each gear and the exact center distance. **[8]**

b) Derive an expression for maximum efficiency in case of spiral gears in terms of spiral angle and angle of friction. **[8]**

OR

Q10)a) A two start worm rotatingat 900 rpmdriving a twenty teeth worm gear. The worm has a pitch diameter of 60 mm and pitch of 18 mm. Coefficient of friction is 0.08. Determine. **[10]**

i) Helix angle of worm.

ii) Speed of gear.

iii) Center distance.

iv) Lead angle for maximum efficiency.

v) Efficiency and maximum efficiency.

b) Derive expressions for pitchcone angles of bevel gears. **[6]**

Q11)a) Derive an expression of speed reduction for epicyclic arrangement of sun, planet and arm by using tabulation method. **[6]**

b) In the epicyclic gear train shown in Fig. 1, the driving wheel A has 14 teeth and the fixed annular wheel C (internal) has 100 teeth. The number of teeth on wheels E and D are 96 and 40 respectively. The wheels are of the same pitch. Wheel A rotates at 1200 rpm,find the speed and direction of wheel C, F is the arm. **[10]**

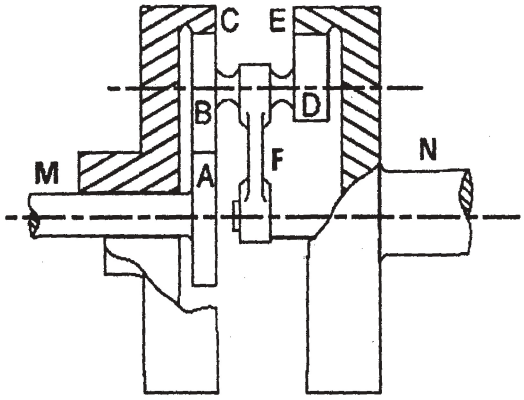

Fig. 1

OR

Q12) In the gear drive shown in the Fig. 2, the driving shaft A rotates at 300 rpm in the clock wise direction, when seen from the left hand side. The shaft B is the driven shaft. The casing C is held stationary. The wheels E and H are keyed to the central vertical spindle and wheel F can rotate freely on this spindle. The wheels K and L are rigidly fixed to each other and rotate together freely on a pin fitted on the underside of F. The wheel L meshes with internal teeth on the casing C. The number of teeth on the different gears is indicated within the bracket. Determine the number of teeth on gear C and speed and direction of rotation of shaft B. **[16]**

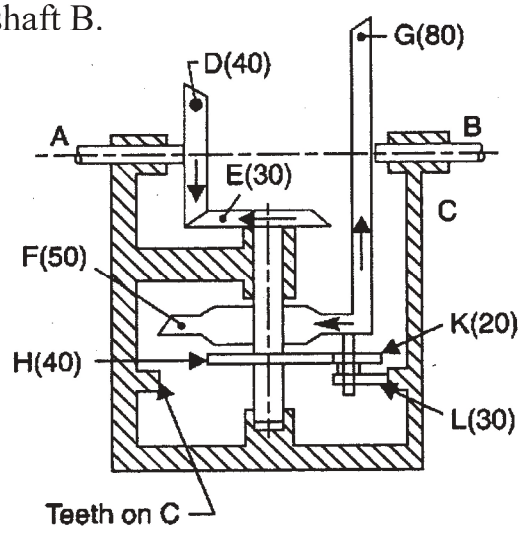

Fig. 2