Total No. of Questions :12]

SEAT No. :

P2812

[Total No. of Pages :5

[4958] - 114

T. E. (Mechanical)

THEORY OF MACHINES - II

(2008 Course) (Semester - I)

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

Instructions to the candidates:

1) ***Answers three questions from Sections I and "three questions from Sections II.***
2) ***Answers to the two Sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rules and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain Friction in slider crank mechanism. **[4]**

b) Derive an expression for frictional torque of a flat collar bearing assuming uniform pressure & uniform wear theory. **[6]**

c) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. **[8]**

OR

Q2) a) Write short note on Epicyclic - train Dynamometer. **[4]**

b) Explain cone clutch with the help of neat sketch. **[4]**

P.T.O.

c) A band and block brake, having 14 blocks each of which subtends an angle of 15° at the centre, is applied to a drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. The two ends of the band are attached to pins on opposite sides of the brake lever at distances of 30 mm and 120 mm from the fulcrum. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, find:

i) Maximum braking torque

ii) Angular retardation of the drum, and

iii) Time taken by the system to come to rest from the rated speed of 360 r.p.m. The coefficient of friction between blocks and drum may be taken as 0.25. **[10]**

Q3) Draw a cam profile to drive an oscillating roller follower to the specifications given below: **[16]**

a) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam;

b) Follower to return to its intial position during next 120° rotation of the cam;

c) Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre = 120 mm; distance between pivot centre and cam axis = 130 mm; minimum radius of cam = 40 mm; radius of roller = 10 mm; inward and outward strokes take place with simple harmonic motion.

OR

Q4) a) Write short note on Eccentric cam. **[4]**

b) What do you mean by advanced cam curves? Explain. **[4]**

c) Derive expressions for displacement, velocity and acceleration for circular arc cam operating a flat faced follower:- **[8]**

i) When the contact has on the nose.

Q5) a) Write short note on: **[6]**

i) Controlling force diagram

ii) Coefficient of insensitiveness.

b) A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions: **[10]**

i) The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.

ii) The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds.

iii) The ship rolls and at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern.

Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.

OR

Q6) a) Derive from the first principles an expression of the gyroscopic couple. **[8]**

b) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. **[8]**

SECTION - II

Q7) a) State and prove the law of gearing. **[4]**

b) 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]**

c) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. **[8]**

OR

Q8) a) Explain the term interference in connection with gears. **[4]**

b) Compare the cycloidal and involute gear tooth profile. **[4]**

c) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. Determine:

i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel,

ii) The length of path and arc of contact,

iii) The number of pairs of teeth in contact, and

iv) The maximum velocity of sliding. **[10]**

Q9) a) Two helical gears are to be used to transmit 150 KW with a velocity ratio of 3:1 in between parallel shafts. The teeth are of involute shape with a normal pressure angle of 20°, normal module of 12.5 mm and standard module of one module, and pinion has 20 teeth and rotates at 600 rpm. If helix angle is 30°, determine;

i) The centre distance,

ii) The axial trust on the gear,

iii) The transverse pressure angle and

iv) Normal tooth load. **[10]**

b) Derive an expression for maximum efficiency in case of spiral gears in terms of spiral angle and angle of friction. **[6]**

OR

Q10)a) A three start worm has a fixed diameter of 80 mm and pitch of 20 mm. It rotates at 750 rpm and drives a 40 tooth worm gear. If coefficient of friction is 0.06, find; **[8]**

i) the helix angle of worm

ii) the speed of gear,

iii) the centre distance,

iv) efficiency,

v) the lead angle for maximum efficiency and

vi) maximum efficiency.

b) A pair of straight bevel gears has a velocity ratio 4:1. The pitch circle diameter of the pinion is 75 mm at the large end of the tooth. A 6 KW power is supplied to the pinion, which rotates at 750 rpm. The face width is 28 mm and pressure angle is 20°. Calculate the tangential, radial and axial component of the resultant tooth force acting on the pinion.**[8]**

Q11) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m. find the speed of shaft B. **[16]**

OR

Q12) a) Explain the terms: **[6]**

i) Simple gear train,

ii) Compound gear train and

iii) Epicyclic gear train, giving one practical example of each with sketch.

b) An electric motor drive a machine through a speed reduction gear of ratio 9:1. The motor armature with its shaft and gear wheel has moment of inertia of 0.65 Kgm^2. The rotating part of the driven machine has moment of inertia of 50 Kgm^2. The driven machine has a resisting torque of 100 Nm, Assuming no loss in the reduction gear find **[10]**

i) Power of the motor at a speed of 150 rpm and

ii) Time required for the speed of machine to increase from zero to 50 rpm, when the torque developed by the motor in starting from rest is 30 Nm.