Total No. of Questions : 10]

P1300

SEAT No. :

[Total No. of Pages : 4

[4858] - 1014

T.E. (Mechanical/Automobile Engg./Mech.-SW)

THEORY OF MACHINES - II (End Semester)

(2012 Pattern) (Semester - I)

Time :2 ½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8,Q.9 or Q.10***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Nonprogrammable Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) State the law of gearing. Derive an expression for constant angular velocity ratio between two gears. **[6]**

b) Two spiral gears in mesh have the following data. **[6]**

l) Angle of friction = 8°

2) Normal pitch = 14 mm

3) Shaft angle = 70°

4) Speed ratio = 2

5) Approximate centre distance = 150 mm

6) Spiral angle of Pinion = 60°.

Determine

i) Exact distance

ii) Number of teeth on each wheel and,

iii) Efficiency of the drive.

Q2) a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20°pressure angle, 10mm module and 10mm addendum.Find the length of path of contact, arc of contact, and the contact ratio. **[6]**

b) Derive an expression for efficiency of worm and worm gears when the worm is driver. **[6]**

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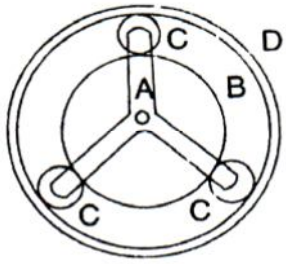
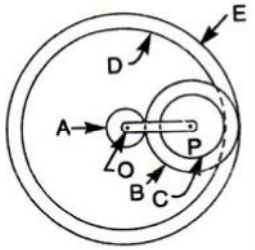
Q3) In an epicyclic gear of the 'sun and planet' type shown in fig.Que.3, the pitch circle diameter of the internally toothed ring is to be 220 mm and the module 5 mm. When the ring D is stationary, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the Sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B.Determine suitable numbers of teeth for all the wheels. **[8]**



Q4) Fig. shows diagrammatically a compound epicyclic gear train. Wheels A,D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P,on the end of arm OP. All the teeth on different wheels have the same module. A has 12 teeth has 30 teeth and Chas 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally. **[8]**

If the wheel A is driven clockwise at 1 r.p.s. while D is driven counterclockwise at 5 r.p.s., determine the magnitude and direction of the angular velocities of arm OP and wheel E.



Q5) a) Write short note on Spheroidal and cone variators with intermediate member. **[6]**

b) The turbine rotor of a ship has a mass of 3400 kg.lt has a radius of gyration of 0.44 m and a speed of 3200 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: **[10]**

i) When the ship is steering to the left on a curve of 90m radius at a speed of 35 km/h.

ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 35seconds and the total angular displacement between the two extreme positions of pitching is 10 degrees.

Q6) a) Explain positive infinitely variable (PIV) drive. **[6]**

b) A motor car negotiates a curve of 45m radius at a speed of 65 km/ hr.Determine the magnitudes of the centrifugal and gyroscopic couples acting on the motor car, and state the effect of each of these on the road reactions on the wheels.Assume that **[10]**

i) Each road wheel has a moment of inertia of 5 kg.m^2 and an effective road radius of 0.6m,

ii) The rotating parts of the engine and transmission are equivalent to a flywheel of mass 85 kg with a radius of gyration of 0.2 m.The engine turns in a clockwise direction when viewed from the front.

iii) The back axle ratio is 4:1, the drive through the gearbox being direct.

iv) The car weighs 15 kN and has its centre of gravity at 0.6 m above the road level. The car takes a right hand turn.

Q7) a) Explain the following terms related to Synthes $\leq$ is of mechanisams:**[8]**

i) Precision positions

ii) Body Guidance

iii) Chebyshev spacing

b) Determine the Chebyshev spacing for the function $y = x^{1.4}$ for the range $1 \leq x \leq 4$ and specify three precision position using graphical approach only.Also determine the values of θ and y. Assume **[8]**

$\theta_s = 30^o$ and $\phi_s = 90^o$ and $\Delta\theta = \Delta\phi = 90^o$

Q8) a) Explain three position synthesis of single slider mechanism by using relative pole method. **[8]**

b) Design a four bar mechanism with input link l, coupler link l_3 and output link l_4 Angles θ and ϕ for 3 successive positions are given below: **[8]**

Position	1	2	3
θ	40^o	55^o	70^o
ϕ	50^o	60^o	75^o

If the grounded link l_1=35 mm, using Frudenstein's equation, find out the lengths of other links to satisfy the given positional conditions. Also draw the synthesized mechanism in its first position and comment on the mechanism obtained.

Q9) a) A cam drives a flat reciprocating follower in the following manner: **[14]**

During first 110°rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 40° of cam rotation. During next 110° of cam rotation,the follower moves inwards with simple harmonic motion.The follower dwells for next 100° of cam rotation .The minimum radius of the cam is 30 mm.Draw the cam profile.

b) Explain the displacement curve for simple harmonic motion of follower.**[4]**

Q10)a) The following data relate to a cam operating an oscillating roller follower:**[14]**

i) Follower to move outward through an angular displacement of 20° during 90° of cam rotation;

ii) Follower to dwell for 40° of cam rotation;

iii) Follower to return to its original position of zero displacement in 75° of cam rotation; and

iv) Follower to dwell for the remaining period of revolution of the cam.

The distance between the pivot centre and the follower roller center is 70 mm and the roller diameter is 18 mm.The minimum radius of the cam corresponds to the starting position of the follower as given in fig. Q.10(a).The location of the pivot point is 70 mm to the left and 60mm above the axis of rotation of the cam.The motion of the follower is to take place with S.H.M.during outstroke and with uniform acceleration and retardation during return stroke.

b) Explain what do you mean by polynomial cam curves. **[4]**

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