Total No. of Questions : 10]

SEAT No. :

P2490

[Total No. of Pages : 3

[5253]-508

T.E. (Mechanical/Automobile)

THEORY OF MACHINES - II

(2015 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data, if necessary.***

Q1) a) Explain the term interference in connection with gear with sketch and the various methods used to avoid it. **[6]**

b) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. If addendum on each wheel is such that path of contact is maximum and interference is just avoided, find the path of contact, arc of contact and contact ratio. Also find the addenda for each wheel. **[7]**

OR

Q2) a) Two horizontal shafts are connected by a pair of spiral gears A and B. The angle between the shafts is 60°. A is driver and rotates 1.5 times as fast as B. A has 40 teeth with helix angle of 25°. The normal pitch is 10 mm. the driving torque applied at A is 30 Nm. Find the pitch circle diameter, the end thrust on each shaft neglecting friction taking normal pressure angle as 20°. **[7]**

b) A two start worm rotating at 800 rpm drives a 26 teeth worm gear. The worm has pitch diameter of 54 mm and a pitch of 18 mm. If the coefficient of friction is 0.06, find **[6]**

i) The helix angle of the worm
ii) Speed of gear.
iii) The centre distance
iv) The lead angle of maximum efficiency
v) Efficiency.
vi) Maximum efficiency.

P.T.O.

Q3) Explain the following terms with the help of a neat sketch : **[7]**

a) Compound and Reverted gear train.

b) Bevel epicyclic gear train.

OR

Q4) An epicyclic gear train is composed of a fixed annular wheel A having 150 teeth. Meshing with A is a wheel B, which drives wheel D through an idle wheel C, D being concentric with A. Wheels B and C are carried on an arm which revolves clockwise at 100 rpm about the axes of A and D. If wheel B and D have 25 and 40 teeth respectively, find the number of teeth on C and speed and sense of rotation of C. **[7]**

Q5) The following data relate to a cam operating an oscillating roller follower, min dia. of cam is 40 mm, dia. of roller is 12 mm, length of follower arm is 50 mm, distance of fulcrum center from cam center is 60 mm, angle of ascent is 120°, angle of decent is 90°, angle of dwell for the follower in the highest position is 60°, angle of oscillation of follower is 34°. Draw the profile of cam if follower lift with uniform acceleration and retardation, acceleration being 2/3 of retardation and decent take place with SHM. **[16]**

OR

Q6) a) What is cam jump phenomenon? Derive the expression for jump velocity for the eccentric cam operating flat face follower. **[10]**

b) What is polynomial curve cam? Derive an expression for displacement, velocity and acceleration for 2-3 polynomial D-R-D cam. **[6]**

Q7) a) Explain the following terms related to synthesis problem. **[4]**

i) Function generation

ii) Body guidance.

b) Design a four bar mechanism to generate the function y = sin x, x varies from 0 to 90°. Angle of input link varies from 30° to 150° and angle of output link varies from 60° to 120°. Assume length for fixed link as a one unit. Use three precision positions from Chebyshev spacing. **[12]**

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OR

Q8) a) Explain the following terms : **[6]**

i) Type synthesis.

ii) Number synthesis.

iii) Dimensional synthesis.

b) Synthesis a four bar mechanism using Freudenstein's equation to satisfy in one of its positions for the following specifications assuming fixed link length as 1 Unit; **[10]**

$\theta = 60°$	$\omega_\theta = 5$ rad/sec	$\alpha_\theta = 2$ rad/sec
$\Phi = 90°$	$\omega_\Phi = 2$ rad/sec	$\alpha_\Phi = 7$ rad/sec

Q9) a) Describe cone variators used to transmit the power between parallel, non-parallel and intersecting shaft axes. **[6]**

b) The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 3000 r.p.m. clockwise when looking from a stern. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots (1 knot = 1855 m/hr). Calculate also the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 seconds and the total angular displacement between the two extreme positions of pitching is 12°. Find the maximum acceleration during pitching motion. **[12]**

OR

Q10)a) Discuss in brief continuously variable transmission. **[6]**

b) A rear engine automobile is travelling along a track of 100 meters mean radius. Each of the four road wheels has a moment of inertia of 2.5 kg-m^2 and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.2 kg-m^2. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3:1. The automobile has a mass of 1600 kg and has its centre of gravity 0.5 m above road level. The width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. Assume that the road surface is not cambered and centre of gravity of the automobile lies centrally with respect to the four wheels. **[12]**

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