

Total No. of Questions : 10]

SEAT No. :

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[5460]-513

T.E. (Mechanical & Automobile Engg.)

THEORY OF MACHINES - II

(2015 Pattern) (Semester - I)

Time : 2½ 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, Q7 or Q.8, Q.9 or Q.10.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Use of electronic non programmable calculator is allowed.*
- 4) *Assume suitable data if necessary.*

Q1) a) State and prove the law of gearing. [4]

- b) Two spiral Gear A and B have 45 and 15 teeth at spiral angles 20° and 50° respectively. Both wheels are of same hand. A is 15cm in diameter. Find the distance between shaft and the angle between shafts. If the teeth are 20° involute form and coefficient of friction 0.08, find the efficiency of gear. [6]

OR

Q2) a) Derive the relation for virtual number of teeth of helical gear. [4]

- b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gear in involute with 20° pressure angle, 12mm module and addendum 10mm. [6]
- Find the Length of Path of Contact
 - Arc of Contact
 - Contact ratio

Q3) a) An Epicyclic gear train consists of Sun wheel S, a Stationary internal Gear E and identical wheels P carried on a Star shaped planet carries C. The sizes of different tooth wheels are such that the planet carries C-rotates at $1/5^{\text{th}}$ of speed of Sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 N-m determine [8]

- i) Number of teeth on different wheels of train.
- ii) Torque necessary to keep the internal gear stationary.

P.T.O.

- b) Define for spur gear [2]
- Pressure angle
 - Module

OR

- Q4)** a) An epicyclic gear train is composed of a fixed annular wheel A having 150 teeth. Meshing with A is 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 revolved clockwise at 200 rpm about the axis of A and D. If the wheels B and D have 25 and 40 teeth respectively. Find [8]
- The no. teeth on C.
 - Speed and sense of rotation of C. Also sketch the arrangement.
- b) Define following terms : [2]
- Helix angle
 - Normal circular pitch

- Q5)** a) What is a Cam jump phenomenon? How cam jump can be minimizing? [4]
- b) Draw the profile for the disc cam having offset 15 mm to the right side of centre of the cam shaft. The base circle Diameter is 75 mm and the Diameter of roller is 10 mm. The follower is move outward a distance with S.H.M. in 140° of the cam rotation to dwell for 40° of cam rotation to move inward with 150° of cam rotation with Uniform acceleration and retardation. Calculate the Maximum velocity and acceleration of the follower during outstroke if the cam shaft rotates at 90 r.p.m. Assume total lift of follower is 40mm. [12]

OR

- Q6)** a) Construct cam profile for knife edge follower with offset to right by 15 mm. Minimum radius of the cam = 30 mm, Stroke of the follower = 24 mm, Angle of rise = 90° , Dwell after rise = 60° , Angle of return = 120° , Dwell after return for the rest of period. Follower to move outwards with uniform velocity and return back with SHM. The cam is to rotate in clockwise direction. [10]
- b) Derive the expression for displacement, velocity and acceleration for 3-4-5 Polynomial D-R-D cam. [6]

Q7) a) Explain with the help of neat sketch Precision position and structural error. [6]

b) Determine the Chebyshev spacing for function $y = x^{1.3}$ for the range $0 \leq x \leq 3$ where three precision points are required. For these precision points, determine $\theta_1, \theta_2, \theta_3$ & ϕ_1, ϕ_2, ϕ_3 if $\Delta\theta = 40^\circ$ & $\Delta\phi = 90^\circ$. [10]

OR

Q8) a) Find the three precision points in the interval of 40° to 120° by using graphical method of Chebyshev spacing. [6]

b) Design a four bar mechanism with input link L_2 , coupler link L_3 & output link L_4 . Angles θ & ϕ for 3 successive positions are given below. [10]

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

If grounded link $L_1 = 30\text{mm}$ using Frudenstein's equation, find out lengths of other links to satisfy given positional conditions.

Q9) a) The turbine rotor of a ship is of mass 3500kg. It has a radius of gyration of 0.45m & a speed of 3000 rpm, clockwise when looking from stern. Determine the gyroscopic couple & its effect upon the ship. [10]

i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36km/h.

ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds & total angular displacement between two extreme positions of pitching is 120° .

b) Explain with the neat sketch continuous & infinite variable transmission. [8]

OR

Q10) a) The propeller of aero weighs 500N & has radius of gyration of 0.8m. The propeller shaft rotates at 2000 rpm, clockwise, as view from tail end. The plane turns left, making a U-turn, i.e, through 180° , of 120 m radius, at a speed of 360km/h, determine the gyroscopic couple and its effect on aircraft. Also find the reactions on bearings if the distance between two bearings of the propeller is 0.75m. [10]

b) Explain PIV chain drive & also write any four advantages of stepless drives. [8]

