

Total No. of Questions :10]

SEAT No. :

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[5153] - 513

T.E. (Mechanical / Automobile Engg./ Mech.-S/W)

THEORY OF MACHINES - II

(2012 Course) (302043) (Semester - I) (End Semester)

Time : 2½Hours]

[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 indicate full marks.
- 4) Assume suitable data, if necessary.

Q1) a) State and prove law of gearing. [6]

b) The following data relate to a pair of 20° involute gears in mesh: Module = 6 mm, Number of teeth on pinion = 17, Number of teeth on gear = 49; Addenda on pinion and gear wheel = 1 module. Find: [6]

- i) The number of pairs of teeth in contact;
- ii) The angle turned through by the pinion and the gear wheel when one pair of teeth is in contact, and
- iii) The ratio of sliding to rolling motion when the tip of a tooth on the larger wheel is just making contact.

OR

Q2) a) Derive an expression for maximum efficiency of worm and worm gears when worm is driver. [6]

b) A pair of bevel gears has a velocity ratio of 3:1. The pitch circle diameter of the pinion is 100 mm at the large end of the tooth. A 7.5 KW power is supplied to the pinion, which rotates at 1000 rpm. The face width is 30 mm and the pressure angle is 20° . Calculate the tangential radial and axial components of the resultant tooth force acting on the pinion. [6]

Q3) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise. [8]

OR

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Q4) Explain tabulation method for sun and planet gear train and write speed of different elements. [8]

Q5) a) Explain PIV drive with neat sketch and state its applications. [6]

b) A four wheel vehicle of mass 2500 kg has a wheel base 2.5 m, track width 1.5 m, and height of centre of gravity 0.6 m above the ground level and lies at 1 m from the front axle. Each wheel has an effective diameter of 0.8 m and a moment of inertia of 0.8 kg.m^2 . The drive shaft, engine flywheel and transmission are rotating at four times the speed of road wheels, in clockwise direction when viewed from the front, and is equivalent to a mass of 80 kg having a radius of gyration of 100 mm. If the vehicle is taking a right turn of 60 m radius at 60 km/h find the load on each wheel. [10]

OR

Q6) a) Explain cone variators with its different arrangements. [6]

b) Find the angle of inclination with respect to the vertical of a two wheeler negotiating a turn. Given: combined mass of the vehicle with its rider 250 kg; moment of inertia of the engine flywheel 0.3 kg-m^2 ; moment of inertia of each road wheel 1 kg-m^2 ; speed of engine flywheel 5 times that of road wheels and in the same direction; height of centre of gravity of rider with vehicle 0.6m; two wheeler speed 90 km/h; wheel radius 300 mm; radius of turn 50 m. [10]

Q7) a) Explain following terms: [6]

- i) Path Generation
- ii) Function Generation and
- iii) Motion Generation.

b) Synthesize a four-bar mechanism to generate a function $y = \sin x$ for $0 \leq x \leq 90^\circ$. The range of the output crank may be chosen as 60° while that of input crank be 120° . Assume three precision points which are to be obtained from Chebyshev spacing. Assume fixed link to be 52.5 mm long and $\theta_1 = 105^\circ$ and $\phi_1 = 66^\circ$. [10]

OR

- Q8) a)** Explain three position synthesis of single slider mechanism by using inversion method. [8]
- b)** Synthesis a four bar mechanism by the method of inversion. [8]

Assume the following data,

- i) Length of fixed link is 80 mm and input link length is 25 mm.
- ii) Initial position of input link 30° and 2-positions of the input link from the initial position 30° and 60° .
- iii) 2-positions of the output link from the initial position 20° and 40° .

And determine the length of coupler link, output link and initial position of output link.

- Q9) a)** Write short note on Jump phenomenon in cam system. [4]
- b)** The following data relate to a cam profile in which the follower is a flat faced follower moving with SHM during ascent and with uniform acceleration and retardation, acceleration being $2/3^{\text{rd}}$ of retardation during descents. Minimum radius of cam = 25 mm, Lift = 30 mm, Angle of ascent = 120° , Angle of descent = 100° , Angle of dwell between ascent and descent = 80° , speed of cam = 200 rpm. Draw profile of the cam and determine maximum velocity and acceleration of the follower during outstroke and return stroke. [14]

OR

- Q10) a)** What do you mean by Advanced Cam Curves? Explain 2-3-4-5 Polynomial curve. [4]
- b)** The following data relate to a cam operating an oscillating roller follower: Minimum radius of cam = 30 mm, Radius of roller = 10 mm, Length of follower arm = 45 mm, Distance of fulcrum centre from cam centre = 55 mm, Angle of ascent = 90° , Angle of descent = 120° , Angle of dwell between ascent and descent = 60° , Angle of oscillation of follower = 25° . Draw profile of the cam if the follower moves with SHM and returns with uniform acceleration and retardation. [14]

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