Total No. of Questions :10]

SEAT No. :

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[Total No. of Pages :3

[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 musst 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^o 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^o. 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 teethon 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 wheelernegotiating 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 riderwith 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 $0 \leq x \leq 90^o$.The range of the output crank may be chosen as 60^o while that of input crank be 120^o. Assume three precision points which are to be obtained from Chebyshev spacing. Assume fixed link to be 52.5 mm long and $\theta_1 = 105^o$ and $\phi_1 = 66^o$. **[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^o and 2-positions of the input link from the initial position 30^o and 60^o.

iii) 2-positions of the output link from the initial position 20^o and 40^o.

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 $2/3^{rd}$ of retardation during descents. Minimum radius of cam = 25 mm, Lift = 30 mm, Angle of ascent = 120^o, Angle of descent = 100^o, Angle of dwell between ascent and descent = 80^o, 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^o, Angle of descent = 120^o, Angle of dwell between ascent and descent = 60^o, Angle of oscillation of follower = 25^o. Draw profile of the cam if the follower moves with SHM and returns with uniform acceleration and retardation. **[14]**

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