Total No. of Questions : 10]

SEAT No. :

P3250

[Total No. of Pages : 4

[5353] - 113
T.E. Mechanical/Auto/ Mech S/W
THEORY OF MACHINES - II

Time :2½ hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables in allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) What is rack shift? Explain why it is done? **[4]**

b) The addendum on each wheel of two mating gears is to be such that the line of contact on each side of the pitch point is half the maximum possible length. The number of teeth on the two gears is 24 and 48. The teeth are of 20° pressure angle involute with a module of 12 mm. Determine the addendum for the pinion and gear also find the contact ratio. **[6]**

OR

Q2) a) The annalus of an epicyclic gear train rotates at 300 rpm about the axis of fixed sun which has 80 teeth. The three armed spider is driven at 180 rpm. Determine the number of teeth required on the planet. **[6]**

b) Explain the force analysis of a worm and worm wheel. **[4]**

Q3) a) State true or false and justify your answer (any 3) **[6]**

i) If the length of path of contact is more, the efficiency is more.

ii) For higher pressure angles, the performance of the gear improves.

iii) If the input and output torques in an epicyclic gear train acts in same direction, the holding toque also acts in same direction.

iv) Contact ratio of spiral gear is greater than the spur gear.

v) Cycloidal profile is chosen for power transmission applications.

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b) The center distance between the meshing gears is 150 mm and the angle between the shaft axes is 60°. The gear ratio is 2 and the normal circular pith is 10 mm. The driven gear has a helix angle of 25° determine the number of teeth on each wheel. **[4]**

OR

Q4) a) What is the significance of helix angle in the worm gears? **[4]**

b) Obtain an expression for minimum number of teeth to avoid interference in a rack and pinion. **[6]**

Q5) a) Compare stepped and step less regulation of speeds. **[4]**

b) A 2.2 tonne racing car has a wheel base of 2.4 m and a track of 1.4 m. The centre of mass of the car lies at 0.6 m above the ground and 1.4 m from the rear axle. The equivalent mass of engine parts is 140 kg with a radius of gyration of 150mm. The back axle ratio is 5. The engine shaft and flywheel rotate clockwise when viewed from the front. Each wheel has a diameter of 0.8 m and a moment of inertia of 0.7 kg m^2. Determine the load distribution on the wheels when the car is rounding a curve of 100 m radius at a speed of 72 km/hour to the (i) left and (ii) right. **[12]**

OR

Q6) a) The turbine rotor of a ship has a mass of 2.2 tonnes and rotate at 1800 rpm clockwise when viewed from the aft. The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple and its effect when the **[12]**

i) Ship turns right at a radius 250 m with a speed of 25 km/hour.

ii) Ship pitches with bow rising at an angular velocity 0.8 rad/s

iii) Ship rolls at an angular velocity of 0.1 rad/s.

b) Explain what is Self-tightening effect in conical displaceable variators?**[4]**

Q7) a) An umbrella mechanism is to be designed for the following relationships between the input and output parameters. **[12]**

- The displacements of the slider 10 mm, 20 mm, and 40 mm from the initial position Initial position of slider 100 mm from crank centre
- The corresponding angular displacements of the output crank are 20°, 40° and 75° from initial position (i.e. 20° with respect to axis of slider).

Use Inversion method to determine the dimensions of the basic mechanism.

b) Define the following terms **[4]**

i) Accuracy points.

ii) Structural error

iii) Function generation

iv) Pole and relative pole.

OR

Q8) a) Explain Function generation using Relative Pole method for slider crank mechanism to coordinate three positions of slider and crank. **[8]**

b) Design a four link mechanism to coordinate three positions of the input and output link for the following angular displacements of the input and output links. Assume the following data: Initial positions of the crank and rocker are 0° and 50° with respect to horizontal; **[8]**

$\theta_{12} = 35° \phi_{12} = 50° : \theta_{13} = 80° : \phi_{13} = 80°$

Take length of fixed link 100mm and length of the rocker 45 mm.

Q9) a) Design a cam profile to operate an inline roller follower using following data **[14]**

- Base circle of radius of the cam: 30 mm
- Radius of the roller: 10mm
- Maximum lift of the follower: 40 mm
- Angle of ascent: 120°
- Angle of dwell: 30°
- Angle of descent: 80°
- Motion of follower during Ascent: SHM
- The follower immediately falls by 10mm at the end of dwell in highest position and further descents with Cycloidal motion by 30 mm.

The cam rotates at uniform speed in clockwise direction. Also draw the pitch circle for the cam designed.

b) Explain what is Undercutting of cams? **[4]**

OR

Q10)a) Explain the following advanced cam curves. Mention the application of each. **[6]**

- Simple polynomial cam
- 3-4-5 polynomial cam

b) Derive and expression for the cam jump of an eccentric cam operating a flat faced follower. **[6]**

c) Explain the effect on the cam profile by varying **[6]**

i) Base Circle Diameter and

ii) Pressure angle