

Total No. of Questions : 10]

SEAT No. :

**P2924**

[Total No. of Pages : 4

**[5669]-513**

**T.E. (Mechanical)**

**THEORY OF MACHINES - II**

**(2015 Pattern)**

**Time : 2 ½ 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, Q.7 or Q.8 and Q.9 or Q.10.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** What are the tooth profiles for gear teeth which fulfill the law of gearing? Compare them. **[4]**

b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 40 teeth gear. The helix angle is  $25^\circ$  and the normal pressure angle is  $20^\circ$ . The normal module is 3 mm. Calculate :

- i) Transverse module
- ii) Transverse pressure angle
- iii) Axial pitch
- iv) Pitch circle diameters of the pinion and gear **[6]**

OR

**Q2) a)** Two  $20^\circ$  involute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and pinion 13 teeth. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? **[6]**

b) Define the following terms related to worm gear : **[4]**

- i) Axial Pitch
- ii) Lead
- iii) Lead angle
- iv) Shaft angle

**P.T.O.**

**Q3)** An epicyclic gear train consists of sun wheel S, stationary internal gear E and identical wheels P carried on a star shaped planet carrier C shown in fig. 1. 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 wheels is 16. The driving torque on sun wheel is 100N-m determine [10]

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

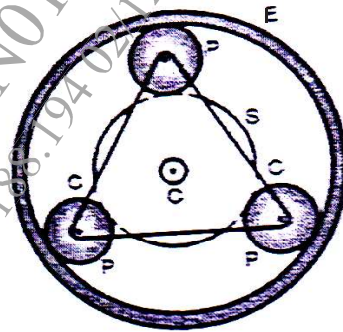


Fig. 1

OR

**Q4) a)** In a reverted epicyclic gear train, the arm E carries two wheels A and D and a compound wheel C and D. The wheel A meshes with wheel B and the wheel D meshes with wheel C. The number of teeth on wheel A, D and C is 78, 46 and 70 respectively. If the arm makes 250 rpm and wheel A is fixed, find the direction and speed of wheel D. [6]

- Explain in detail simple and compound gear train. [4]

**Q5) a)** How the followers are classified? Describe in detail any two types of followers. [6]

- An eccentric plate circular cam of eccentricity 40 mm provides motion to a spring loaded follower of mass 2 Kg whose axis perpendicular of the cam and passes through its center. The spring has a stiffness of 25N/mm. It is found that at certain speed, the follower ceases the contact with cam when it is rotated through 110 degrees from its lowest position. Determine the initial speed if the initial compression of the spring is 32 mm, determine also limiting speed of the cam. [10]

OR

**Q6) a)** The following data relate to a cam operating an oscillating roller follower Minimum radius of the cam = 44 mm, roller diameter = 14 mm, lift = 28 mm. length of the follower arm = 40mm, distance of fulcrum center from cam center = 50mm angle of ascent =  $75^\circ$  angle of descent =  $105^\circ$  angle of dwell for follower in the highest position =  $60^\circ$  angle of oscillation of the follower =  $28^\circ$  Draw the profile of cam if the ascent and descent both take place with SHM. [12]

b) Explain cam jump phenomenon with diagram. [4]

**Q7) a)** Explain the task of kinematic synthesis in detail. [8]

b) Determine the chebychev spacing for the function  $y = x^{1.5}$  for the range  $0 \leq x \leq 3$  where three precision points are required. For these points, determine  $\theta_2, \theta_3$  and  $\phi_2, \phi_3$  if  $\Delta\theta = 40^\circ$  and  $\Delta\phi = 90^\circ$  [8]

OR

**Q8) a)** Explain the following terms : [8]

i) Synthesis of mechanism

ii) Type synthesis

iii) Number synthesis

iv) Dimensional synthesis

b) Design a four bar mechanism with input link coupler link and output link and Angle  $\theta$  and  $\phi$  for three successive positions are given in table below.

Position	1	2	3
$\theta$	$40^\circ$	$55^\circ$	$70^\circ$
$\phi$	$50^\circ$	$60^\circ$	$75^\circ$

If the grounded link 30 mm using Freudenstein's equation find out length of other links to satisfy the given positional conditions. [8]

- Q9) a)** Explain Positive Infinitely Variable [PIV] drive. [6]
- b)** The rotor of the turbine of a ship has a mass of 2.2 tones and rotates at a speed of 1800 rpm clockwise when viewed from the aft. The radius of rotor is 320 mm. Determine the gyroscopic couple and its effect when rotor has a radius of gyration of 0.4 m. Determine the gyroscopic couple and its effect when.
- The ship turns right at a radius of 250m with a speed of 25 Km/h.
  - The ship pitches with the bow rising at an angular velocity of 0.8 rad/sec.
  - The ship rolls at an angular velocity of 0.1 rad/sec. [12]

OR

- Q10) a)** Explain the following :
- Disc variators
  - Cone variators [6]
- b)** An Aeroplane flying at 240 Km/h turns towards left and completes a quarter circle of 60 m radius. The mass of rotary engine and the propeller of the plane amounts to 450 Kg with a radius of gyration of 320 mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple and its effect. In what way is the effect changed when
- Aeroplane turns towards right.
  - the engine rotates clockwise when viewed from the front and Aeroplane turns a) left b) right. [12]

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