

## GANPAT UNIVERSITY

B. Tech. Semester: III<sup>rd</sup> (Mechatronics) Engineering

CBCS Regular Examination November – December 2014

(2MC304) KINEMATICS

Time: 3 Hours

Total Marks: 70

- Instruction:**
- 1 All questions are compulsory.
  - 2 Figure right to the questions indicate full marks.
  - 3 Draw figures and give proper notations.

Section – I

- Que - 1**
- (a) Explain the Ackermann steering gear mechanism with neat sketch. [06]
- (b) Explain the Differential gear box with neat sketch. [06]

OR

- Que - 1**
- (a) Explain the velocity of rubbing with neat sketch. [04]
- (b) The crank of slider crank mechanism rotates clockwise at a constant Speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine (1) linear velocity and acceleration of the mid point of the connecting rod, (2) angular velocity and angular acceleration of the connecting rod, at a crank angle of  $45^\circ$  from the inner dead centre. [08]

- Que - 2**
- (a) What is the difference between a simple gear train and compound gear train? Explain with the help of sketches. [05]
- (b) A torsion dynamometer is fitted to a propeller shaft of a marine engine. It is found that the shaft twist  $2^\circ$  in a length of 20 m at 120 rpm. If the shaft is hollow with 400 mm external diameter and 300 mm internal diameter, find the power of the engine. (Modulus of rigidity for the shaft material = 80 GPa). [07]

OR

- Que - 2**
- (a) What are the types of absorption dynamometer? Explain any one of them with neat sketch. [05]
- (b) In an epicyclic gear train is shown in figure (A). The number of teeth on A and B are 80 and 200. Determine the speed of arm A, (1) if A rotates at 100 rpm clockwise and B at 50 rpm anticlockwise, (2) if A rotates at 100 rpm clockwise and B is stationary. [07]

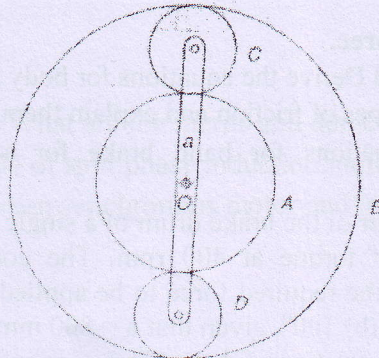


Fig. – (A)

- Que - 3 (a) Classify and explain the follower according to shape of the follower with neat sketch. [03]
- (b) Base on the following data in drawing the profile of cam in which a roller follower is raised and lowered with simple harmonic motion : [08]
- Radius of roller = 10 mm  
Least radius of cam = 25 mm  
Lift of follower = 50 mm  
Angle of ascent =  $120^\circ$   
Angle of dwell between ascent and decent =  $30^\circ$   
Angle of descent =  $60^\circ$   
Remaining angle of dwell =  $150^\circ$   
Cam rotation is in clockwise direction.

Section - II

- Que - 4 (a) Define (1) Mechanism (2) Machine (3) Rigid Body (4) Structure (5) linkage (6) Inversions. [06]
- (b) Draw and Explain the Inversions of the four bar chain mechanism. [06]

OR

- Que - 4 (a) Enlist approximate straight line motion mechanism and explain any one of them. [06]
- (b) Draw and Explain the Inversions of the double slider crank mechanism. [06]

- Que - 5 (a) Derive the equations for when body is moving down the plane with neat sketch. [06]
- (b) In the thrust bearing, the external and the internal diameters of the contacting surface are 320 mm and 200 mm respectively. The total axial load is 80 kN and the intensity of pressure is  $350 \text{ kN/m}^2$ . The shaft rotates at 400 rpm. Taking  $\mu = 0.06$ , calculate the power lost in overcoming the friction. Also find the number of collars required for the bearing. [05]

OR

- Que - 5 (a) Derive the equations of flat collar bearing for (1) Uniform pressure, (2) Uniform wear. [06]
- (b) An Effort of 1500 N is required to just move a body up on incline plane of angle  $12^\circ$ , force acting parallel to the plane. If the angle of inclination is increased to  $15^\circ$ , then the effort required is 1720 N. find the weight of body and coefficient of friction. [05]

- Que - 6 Attempt any Three. [12]
- (a) Explain and Derive the equations for body at the rest with neat sketch.
- (b) State the types of friction and explain them in details.
- (c) Derive equations for band brake for  $a > b$ , F downwards for both rotations.
- (d) The diameter of the brake drum of a single block brake is 1m. It sustains 240 Nm of torque at 400 rpm. The coefficient of friction is 0.32. Determine the required force to be applied when the angle of contact is (a)  $35^\circ$  and (b)  $100^\circ$ , given that  $a = 800 \text{ mm}$ ,  $b = 150 \text{ mm}$  and  $c = 25 \text{ mm}$ . Assume the rotation of drum clockwise and anticlockwise.

\*\*\*\*\* END OF PAPER \*\*\*\*\*