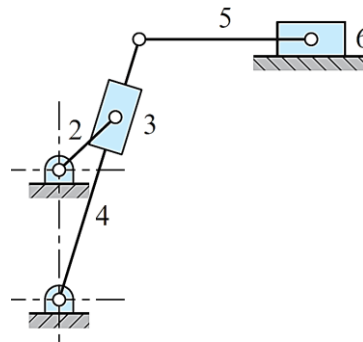


Exam	Model Question		
Level	B.E.	F. M.	60
Program	BME	P. M.	24
Year / Part	III/I	Time	3 hrs.

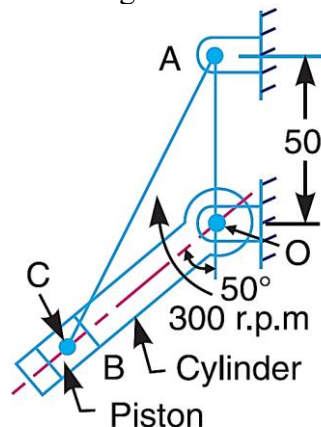
Subject: Theory of Mechanism and Machine (ENME 303)

- Candidates are required to give their answers in their own words as far as practicable.
- Attempt **all** questions. Figure in the margin indicates **Full marks**.
- Assume suitable data if necessary.

- 1 Define kinematic chain and kinematic pair with example. Calculate the degree of freedom of mechanism shown in figure. [3+3]



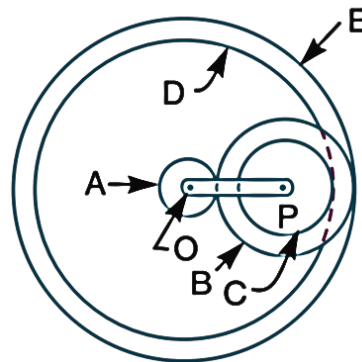
- 2 The kinematic diagram of one of the cylinders of a rotary engine is shown in Figure. The crank OA which is vertical and fixed, is 50 mm long. The length of the connecting rod AB is 125 mm. The line of the stroke OB is inclined at 50° to the vertical. The cylinders are rotating at a uniform speed of 300 r.p.m., in a clockwise direction, about the fixed center O. Determine: [8]
1. Acceleration of the piston inside the cylinder, and
 2. Angular acceleration of the connecting rod.



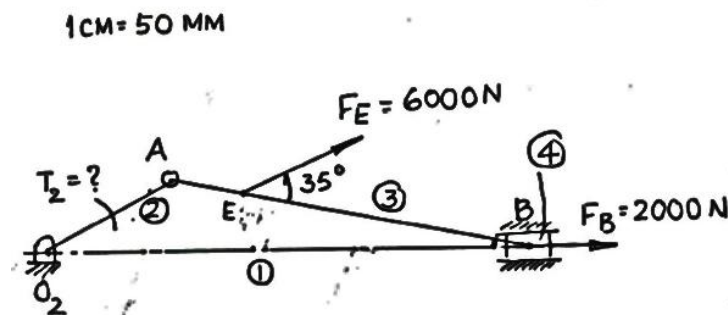
- 3 Discuss on dimensional synthesis of planar mechanisms. Synthesize a four bar linkage using Freudenstein's equation to generate the function $y = x^{1.8}$ for the interval $1 \leq x \leq 5$. The input crank is to start from $\theta_s = 30^\circ$ and is to have a range of 90° . The output follower is to start at $\phi_s = 0^\circ$ and is to have a range of 90° . Take three accuracy points at $x = 1, 3$ and 5 . [2+6]
- 4 Describe the uniform acceleration motion of the follower in a cam mechanism with displacement diagram. A cam rotating clockwise at a uniform speed of 1000 r.p.m. is required to give a roller follower the motion defined below: [2+4]
1. Follower to move outwards through 50 mm during 120° of cam rotation,
 2. Follower to dwell for next 60° of cam rotation,
 3. Follower to return to its starting position during next 90° of cam rotation,
 4. Follower to dwell for the rest of the cam rotation.

The minimum radius of the cam is 50 mm and the diameter of roller is 10 mm. The line of stroke of the follower is off-set by 20 mm from the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, find the maximum velocity and acceleration during out stroke and return stroke.

- 5 Explain center distance in gearing. Determine the expression for minimum number of teeth in order to avoid interference in rack and pinion. [2+4]
- 6 A right-hand helical pinion is to drive a gear at a shaft angle of 90° . The pinion has 6 teeth and a 75° helix angle and is to drive the gear at a velocity ratio of 6.5. The normal diametral pitch of the gear is 12 teeth/in. Calculate the helix angle and the number of teeth on the mating gear. [4]
- 7 Figure shows diagrammatically a compound epicyclic gear train. Wheels A, D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have the same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally. If the wheel A is driven clockwise at 1 r.p.s. while D is driven counter clockwise at 5 r.p.s., determine the magnitude and direction of the angular velocities of arm OP and wheel E. [6]



- 8 Determine T_2 to keep the body in equilibrium. $O_2A = 100\text{mm}$, $AB = 250\text{mm}$, $AE = 50\text{mm}$, $\angle AO_2B = 30^\circ$. [8]



- 9 Determine the expression for the balancing of several masses rotating in the same plane. [4]
- 10 Explain how is energy stored in flywheel. [4]
