Code No. : 15559 N

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (Mech. Engg.) V-Semester Main Examinations, Jan./Feb.-2024
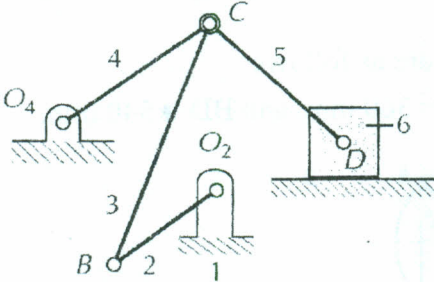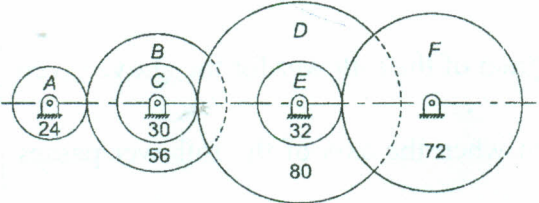## Kinematics of Machines

Time: **3 hours**   Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Calculate the degrees of freedom / mobility for the given mechanism.	2	2	1	1,2
2.	Define the terms Mechanism ,Machine and a Structure.	2	1	1	1,2
3.	What is a configuration/space diagram and state it's use?	2	1	2	1,2
4.	What is the Coriolis acceleration component? State in which case it occurs and how is it determined.	2	1	2	1,2
5.	Write the fundamental equation of steering gears and name the steering gear which fulfills this condition at all positions.	2	1	3	1,2
6.	List any two advantages and disadvantages of V-belt drive over Flat belt drive.	2	1	3	1,2
7.	How are the cams classified?	2	1	4	1,2
8.	List the various types of followers.	2	1	4	1,2
9.	Define the terms path of contact and module in gears.	2	1	5	1,2
10.	A Compound gear train as shown in the figure below, consists of compound gears B-C and D-E. All gears are mounted on parallel shafts. The motor shaft rotating at 800 rpm is connected to the gear A and the output shaft to the gear F. The number of teeth on gears A,B,C,D,E and F are 24,56,30,80,32 and 72 respectively. Calculate the speed of the gear F.	2	2	5	1,2

Part-B (5 × 8 = 40 Marks)

11. a)	Discuss in brief about the different types of kinematic pairs available for planar mechanisms, with their degree of freedom.	4	2	1	1,2
b)	Explain all the inversions possible in a closed kinematic chain with four links connected by revolute joints/turning pairs.	4	3	1	1,2
	Note: Consider all the links are having different dimensions.				

12. In the toggle mechanism shown in the figure below, the slider D is constrained to move on a horizontal path. | 8 | 4 | 2 | 1,2

The crank OA rotates in the counterclockwise direction at a speed of 180rpm

The dimensions of the various links are as follows:

OA = 180 mm, CB = 240 mm, AB = 360 mm and BD = 540 mm.

For the given configuration , using relative velocity method

a) Calculate the velocity of slider D and

b) The angular velocity of BD using relative velocity method

13. a)	Derive the expression for the length of the belt in the case of open belt drive, in terms of the pulley diameters and the centre distance between the pulleys.	4	3	3	1,2
b)	A belt runs over a pulley of 800mm diameter at a speed of 180 rpm. The angle of lap is 165^0 and the maximum tension in the belt is 2000N.	4	3	3	1,2
	Compute the power transmitted if the coefficient of friction between the belt and the pulley is 0.3				

14. A cam operating a roller reciprocating follower has the following data:

The cam lifts the follower for 120^0 with SHM (Simple Harmonic Motion) followed by a dwell period of 30^0 .

Then the follower lowers down during 150^0 of the cam rotation with uniform acceleration and deceleration followed by a dwell period.

Consider the Minimum radius of the cam = 25mm , Lift=30mm and Roller diameter =15mm

a)	Draw the displacement diagram of the follower for the above given details	3	3	4	1,2
b)	Draw the profile of the cam when the axis of the follower passes through the cam axis	5	3	4	1,2

			M	L	CO	PO
15.	a)	State and derive the Law of Gearing	4	3	5	1,2
	b)	Each of two gears in a mesh has 48 teeth and a module of 8mm. The teeth are of 20^0 involute profile, the arc of contact is 2.25 times the circular pitch. Determine the addendum.	4	4	5	1,2
16.	a)	Discuss in brief about the different types of links and joints available for planar mechanisms	4	2	1	1,2
	b)	Explain the concept of instantaneous centre for velocity analysis of any planar mechanism	4	2	2	1,2
17.		Answer any *two* of the following:				
	a)	Explain in brief about slip, creep and initial tension in the case of belt drives.	4	2	3	1,2
	b)	Discuss the nomenclature of a radial cam.	4	2	4	1,2
	c)	Explain with neat sketches any two gear trains.	4	2	5	1,2

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	45%

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