U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

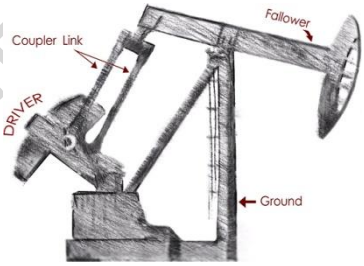
Branch: Mechanical Engineering **Duration: 3 hrs.**

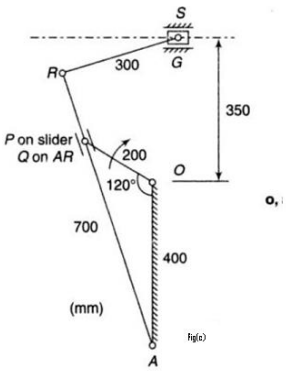
Course Code: 19ME4DCKOM **Max Marks: 100**

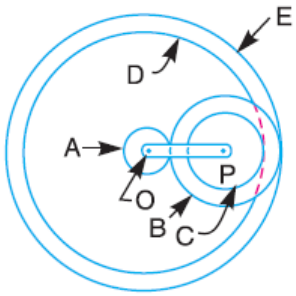
Course: Kinematics of Machines

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT – I	CO	PO	Marks
1	a)	Explain the following terms: (i) Kinematic link (ii) Grashof's law (iii) Higher pair (iv) Structure	*CO1*	*PO1*	**08**
	b)	Sketch and explain the working of an elliptical trammel. Prove that it traces an ellipse	*CO1*	*PO2*	**08**
	c)	Determine the degrees of freedom for the given example as shown below Fig. 1c.  Fig. 1c	*CO1*	*PO2*	**04**
		OR			
2	a)	Explain the Whitworth quick return motion mechanism, with a neat sketch.	*CO1*	*PO1*	**10**
	b)	Define "Exact straight line motion". Prove that a point on the Peaucellier's mechanism traces an exact straight line.	*CO1*	*PO2*	**10**
		UNIT – II			
3	a)	What is Coriolis component of the acceleration? Derive the expression for the same.	*CO1*	*PO2*	**08**

		b)	A four bar mechanism ABCD is made up of four links, pin jointed at the ends. AD is fixed link which is 180 mm long. The links AB, BC and CD are 90 mm, 120 mm and 120 mm long respectively. At certain instant, the link AB makes an angle of 60˚ with the link AD. If the link AB rotates at a uniform speed of 100 rpm clockwise, determine: i) angular velocity of the link BC and CD and ii) angular acceleration of the links CD and CB	*CO1*	*PO2*	**12**
			OR			
	4		Figure 4 shows the link mechanism of a Quick return mechanism of the slotted lever type, the various dimensions of which are OA=400 mm, OP=200 mm, AR=700 mm, RS = 300 mm. For the configuration shown determine the acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates at 210 rpm.  Fig. 4	*CO1*	*PO2*	**20**
			UNIT - III			
	5	a)	What is instantaneous centre of rotation? State Kennedy's theorem.	*CO2*	*PO1*	**05**
		b)	In a reciprocating engine, the length of crank is 250 mm and length of connecting rod is 1000 mm. The crank rotates at a uniform speed of 300 rpm in clockwise direction and the crank is inclined at 30° with inner dead Centre. The Centre gravity of the connecting rod is 400 mm away from the crank end. By Klein's construction method, determine: (i) Velocity and acceleration of piston. (ii) Angular velocity and angular acceleration of connecting rod and (iii) Velocity and acceleration at the centre of gravity of the connecting rod.	*CO2*	*PO2*	**15**
			OR			
	6	a)	State and prove law of gearing.	*CO2*	*PO1*	**10**
		b)	Two 20^{o} involute spur gears mesh externally and give a velocity	*CO2*	*PO2*	**10**

			ratio of 3. The module is 3 mm and the addendum is equal to 1.1 module. If the pinion rotates at 120 rpm. Determine: (i) Minimum number of teeth on each wheel to avoid interference (ii) Contact ratio			
			UNIT - IV			
	7	a)	Sketch and explain different types of gear train.	*CO3*	*PO1*	**08**
		b)	Fig. 7b shows diagrammatically a compound epicyclical 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 1r.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.  Fig. 7b	*CO3*	*PO2*	**12**
			OR			
	8	a)	Explain with a neat sketch of sun and planet type gear train.	*CO3*	*PO1*	**08**
		b)	In an epicyclical gear train, the internal wheels A, B and compound wheel C & D rotate independently about the axis 'o'. The wheel E and F rotate on a pin fixed to the arm G. E gears with A and C, and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, on C=28 and on D= 26. (i) Sketch the arrangement (ii) Find the number of teeth on A and B. (iii) If the arm G makes 150 rpm in clockwise direction and A is fixed, find the speed of gear.	*CO3*	*PO2*	**12**
			UNIT - V			
	9	a)	Briefly discuss the various types of followers used for cam profile.	*CO4*	*PO1*	**06**
		b)	A cam rotating clockwise at uniform speed of 300 rpm operates a	*CO4*	*PO2*	**14**

			reciprocating follower, through a roller 1.5 cm diameter. The follower motion is defined as below: (i) Outward during 150° with UARM (ii) Dwell for next 30° (iii) Return during next 120°with SHM (iv) Dwell for the remaining period. Stroke of the follower is 3 cm; minimum radius of the cam is 3cm. Draw the cam profile, when the follower axis passes through cam axis.			
			OR			
	10	a)	Discuss briefly the various types of cams.	*CO4*	*PO1*	**08**
		b)	Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150º of the rotation followed by a period of dwell for 60º.The follower descends for the next 100º rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return?	*CO4*	*PO2*	**12**

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