		Reg. No.								
MANIPAL INSTITUTE OF TECHNOLOGY										
TASAIRED BY LIT	MANIPAL (A constituent unit of MAH	IE, Manipal)								

DEPARTMENT OF MECHATRONICS V SEMESTER B.TECH. MECHATRONICS

END SEMESTER EXAMINATION, Nov 2022

SUBJECT: THEORY OF MACHINES [MTE 3154]

(22-11-2022)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

✤ Data not provided may be suitable assumed.

Q.		Μ	CO	РО	LO	BL
1A.	Classify the kinematic pairs based on nature of contact and based on nature of mechanical constraint. Explain each with an example.	2	1	1	1	L2
1 B .	With a sketch explain the working principle of Watt's straight line mechanism and explain its practical application.	3	1	2	2	L2
1C.	Develop the inversions of a slider crank mechanism i) by fixing the connecting rod of the mechanism, which is used for quick return motion and ii) by fixing the slider of the mechanism. Explain with relevant sketches	5	1	2	2,3	L3
2A.	Explain Order defect and branch defect in synthesis of mechanism	2	5	1	1,4	L2
28	A four bar mechanism is to be designed, by using three precision points to generate the function $y = x^{1.5}$ for the range $1 \le x \le 4$. Assume 30 degree starting position and 120 degree finishing position for the input link and 90 degree starting position and 180 degree finishing position for the output link, find the values of x, θ and \emptyset corresponding to the three precision points using chebychev spacing.	3	5	4	4	L3
2C	The dimensions of a four bar mechanism is as follows. $P_1A = 300$ mm, $AB = 360$ mm, $P_2B = 360$ mm, $P_1P_2 = 600$ mm which is fixed. The angle $AP_1P_2 = 60$ degree. The crank P_1A has an angular velocity of 10 rad/sec and an angular acceleration of 30 rad/sec ² , both clockwise. Determine the angular velocities and angular acceleration of P_2B and AB and the velocity and acceleration of the joint B.	5	2	4	2,3	L4
3A	How does flywheel differ from a governor? Explain	2	3	1	1	L2
38	A punching machine carries out 6 holes per minute. Each hole of 40 mm diameter in 35 mm thick plate requires 8 Nm of energy/mm ² of the sheared area. The punch has a stroke of 95 mm. Find the power of the motor required if the mean speed of the flywheel is 20 m/s. If total fluctuation of speed is not to exceed 3% of the mean speed. Determine the mass of the flywheel.	3	3	3	1	L3

3 C	A rotating shaft carries four unbalanced mass 18kg, 14kg, 16kg and	5	3	2,3	2,3	
	12kg at radii 50mm, 60mm, 70mm and 60mm respectively. The					
	second, third and fourth mass revolve in planes 80mm, 160mm,					
	280mm respectively from the first mass and angularly at 60° , 135 [°] and					
	270° respectively in ACW from first mass. The shaft dynamically					
	balanced by adding two masses at radii 50mm and first mass revolving					
	in midway between first and second and second mass revolving in					
	midway between third and fourth. Determine the angular position and					
	magnitude of the balance mass required					L4
1.4	Make a comparison of evaluated and involute tooth form (Minimum	2	1	1	1	
44	six differences).	4	-	L	1	L2
4B	Derive an expression for the minimum number of teeth required on a	3	4	2	2,3	
	wheel in order to avoid interference in involute gear teeth when it					12
	meshes with a pinion					LO
4 C	Two mating gears have 20 and 40 involute teeth of module 10mm and	5	3	3	1	
	20° pressure angle. The addendum on each wheel is to be made of such					
	a length that the path of contact on each side of the pitch point has half					
	the maximum possible length. Determine the addendum height for					
	each gear wheel, length of the path of contact, arc of contact and					L4
54	A pair of spur gears with involute teeth is to give a gear ratio of 4.1	3	4	3	1	
011	The arc of approach is not to be less than the circular pitch and smaller	v	•	U	•	
	wheel is the driver. The angle of pressure is 14.5° . Find a). The least					
	number of teeth that can be used on each wheel, b) The addendum of					12
	the wheel in terms of the circular pitch.					LS
5B	Determine a suitable train of wheels to satisfy the requirements of a	3	4	4	4	
	clock, the minute hand of which is fixed to a spindle and the hour hand					
	to a sleeve rotating freely on the same spindle. The pitch is the same					
	for all the wheels and each wheel has at least 11 teeth. The total					L5
50	In an epicyclic gear train, the internal wheels A B and the compound	1	1	1	23	
30	wheels C and D rotate independently about axis O. The wheels E and	-	-	-	2,3	
	wheels C and D lotate independently about axis O. The wheels E and E restate on mine fixed to the same C . E goods with A and C and E goods					
	F fotate on phis fixed to the arm G. E gears with A and C and F gears					
	with D and D . All wheels have the same module and number of teeth					
	are $IC = 32$; $ID = 26$; $IE=IF=20$.					
	a) Sketch the arrangement					
	b) It arm G makes 100 rpm clockwise and A is fixed, find speed &					
	direction of rotation of B					
	c) If arm G makes 100 rpm counter clockwise and wheel A makes 10 rpm clockwise find the speed of wheel B					L4
	rpm clockwise, find the speed of wheel B					

L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, L6-Creating