Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2026

Third Semester

Agricultural Engineering

UMETL24305 – MECHANICS OF MACHINES

Regulations - 2024

Duration : 3 Hrs **Maximum : 100 Marks**

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BTL	CO	Marks
1.	Define Gruebler's criterion for a planar mechanism.	L1	1	2
2.	Differentiate between a machine and a structure.	L2	1	2
3.	Define toothed gearing.	L1	2	2
4.	What is interference and undercutting in spur gears?	L1	2	2
5.	What is the function of lead and pitch of a screw thread?	L2	3	2
6.	Differentiate between self-energizing and self-locking brakes.	L2	3	2
7.	Define Tractive Effort in a mechanism.	L1	4	2
8.	What is the primary function of a flywheel in an engine?	L2	4	2
9.	Define static balancing and dynamic balancing.	L1	5	2
10.	Differentiate between free vibration and forced vibration.	L2	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No			Questions	BLT	CO	Marks
11	a	i	Define a kinematic chain and classify kinematic pairs based on the nature of contact and the nature of relative motion with examples for each.	L2	1	8
		ii	Explain the four inversions of a single slider crank chain with neat sketches, and state one practical application for each inversion.	L2	1	8
			Or			
	b	i	Explain with neat sketches the procedure for determining the velocity and acceleration of the piston and the angular velocity of the connecting rod in a slider crank mechanism using the Relative Velocity and Acceleration Method.	L2	1	10
		ii	Explain Grashoff's Law and its importance in designing four-bar mechanisms.	L2	1	6
12	a	i	Derive the expression for the minimum number of teeth on a pinion to avoid interference in an involute spur gear drive.	L3	2	6
		ii	A pair of 20^{o} full depth involute spur gears has 30 and 50 teeth respectively of module 4 mm. The gears are in mesh. Determine the length of the path of contact and the contact ratio.	L3	2	10
			Or			
	b	i	Illustrate the applications of compound gear train for an automotive transmission systems that required precise speed and torque control.	L3	2	6
		ii	An epicyclic gear train consists of an annular gear A having 100 teeth and a pinion B having 20 teeth. An arm C carries a compound gear D having 40 teeth which meshes with both A and B. If the arm C rotates at 100 rpm clockwise, find the speed and direction of rotation of gear B when the annular gear A is fixed.	L3	2	10

13	a	i	Derive the expression for the torque transmitted by a flat collar bearing considering the Uniform Wear Theory.	L4	3	6
		ii	A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surface is 240 mm and the inside diameter is 120 mm. Assuming uniform wear and a coefficient of friction of 0.3, analyze the maximum axial intensity of pressure required between the discs for transmitting 25 kW at 1575 rpm.	L4	3	10
			Or			
	b	i	Derive the expression for the ratio of tensions (T_1/T_2) in a flat belt drive, including the effect of centrifugal tension on the effective driving tension.	L4	3	9
		ii	A belt drive is used to transmit power. The diameter of the driving pulley is 450 mm and the driven pulley is 900 mm. The centre distance between the shafts is 3 m. The smaller pulley runs at 240 rpm. The coefficient of friction is 0.3 and the maximum tension in the belt is 2000 N. Determine and analyze the maximum power that can be transmitted by the belt.	L4	3	7
14	a	i	Explain the difference between static force analysis and dynamic force analysis in mechanisms.	L2	4	6
		ii	A four-bar mechanism is subjected to an external load F applied at the midpoint of link 3. Using the Principle of Virtual Work, develop the methodology to determine the required input torque on the crank (link 2) to maintain static equilibrium.	L3	4	10
			Or			
	b		A single cylinder horizontal engine runs at 240 rpm. The crank is 200 mm long and the connecting rod is 800 mm long. The mass of the reciprocating parts is 120 kg. When the crank is 30° from the inner dead centre, determine the following: (i) Velocity and acceleration of the piston. (6) (ii) Net force acting on the piston due to inertia forces (neglecting gas pressure). (10)	L3	4	16
15	a	i	Explain the procedure for balancing of several masses revolving in different planes using the graphical method, detailing the construction of the force and couple polygons.	L2	5	10
		ii	Define the term 'Critical Speed' of a shaft and explain why it is important to operate a machine away from this speed.	L2	5	6
			Or			
	b	i	With clear diagrams, explain the phenomenon of vibration isolation and define the terms vibration transmissibility and isolation factor.	L2	5	8
		ii	Derive the expression for the Natural Frequency of a simple spring-mass system for undamped free longitudinal vibration.	L2	5	8

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