

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025****Fourth Semester****Mechanical Engineering****ME3491 - Theory of Machines****(Common to Third Semester Agricultural Engineering)****Regulations - 2021****Duration : 3 Hrs****Maximum : 100 Marks****PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)**

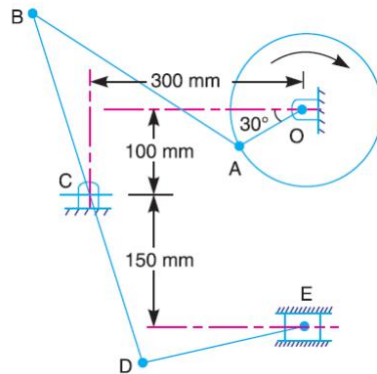
Q.No	Questions	BLT	CO	Marks
1.	What is meant by inversion of mechanism?	L1	1	2
2.	What is maximum velocity and acceleration of the follower on both the strokes of uniform acceleration and retardation?	L2	1	2
3.	What is the condition stated by law of gearing?	L1	2	2
4.	What are the methods to avoid interference and undercutting?	L1	2	2
5.	Why self-locking screws have lesser efficiency?	L2	3	2
6.	State the functional difference between a clutch and a brake.	L2	3	2
7.	Differentiate the functions of flywheel and governor.	L2	4	2
8.	Define maximum fluctuation of energy.	L1	4	2
9.	Why are the cranks of a locomotive, with two cylinders, placed at 90° to each other?	L1	5	2
10.	In case of balancing of rotary masses in different planes how many planes in which balancing masses will be kept?	L2	5	2

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

Q.No	Questions	BLT	CO	Marks
11. a	A cam is to give the following motion to a knife edged follower: (a) Outstroke during 60° of cam rotation (b) Dwell for the next 45° of cam rotation (c) Return stroke during next 90° of cam rotation (d) Dwell for the remaining of cam rotation The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when, (i) The axis of the follower passes through the axis of the cam shaft (ii) The axis of the follower is offset by 20 mm from the axis of the cam shaft	L3	1	16

Or

- b In a mechanism as shown in Fig, the crank OA is 100 mm long and rotates in a clockwise direction at a speed of 100 r.p.m. The straight rod BCD rocks on a fixed point at C. The links BC and CD are each 200 mm long and the link AB is 300 mm long. The slider E, which is driven by the rod DE is 250 mm long. Find the velocity and acceleration of E.



12. a A drive on a machine tool is to be made by two spiral gear wheels, the spirals of which are of the same hand and has normal pitch of 12.5mm. The wheels are of equal diameter and the center distance between the axes of the shafts is approximately 134 mm. the angle between the shafts is 80° and the speed ratio 1.25. Determine
- The spiral angle of each wheel
 - The number of teeth on each wheel
 - The efficiency of the drive, if the friction angle is 6°
 - The maximum efficiency

Or

- b In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in anticlockwise direction about the center of the gear A which is fixed, determine the speed of the gear B. if the gear A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B?

13. a A screw jack is used to raise 50 kN of load. The spindle of the screw jack moves in a fixed nut and has a single start square thread of 60 mm mean diameter having a pitch of 20 mm. The coefficient of friction between the screw and nut is 0.12. Effort is applied at the end of a single lever having an effective length of 0.75m. The land is prevented from revolving and it is carried on a swivel seat, the bearing surface of which has mean radius of $\frac{4}{3}$ times that of threads. The coefficient of friction between the seat and spindle is 0.10. Find the force applied at the end of the lever when the land is raised. Also, find the mechanical efficiency of the screw jack. Check whether the screw jack is self locking or not?

Or

- | | | | | |
|-----------|--|----|---|----|
| b | <p>An open belt running over two pulleys of 1.5 m and 1.0 m diameters connects two parallel shafts 4.8 m apart. The initial ten in the belt is 3000 N. The smaller pulley is rotating at 600 rpm. The mass of belt is 0.6703 kg/m length. The coefficient of friction between the belt and pulleys is 0.3. Find</p> <ul style="list-style-type: none">(i) The exact length of the belt required(ii) The power transmitted taking c.f tension into account | L2 | 3 | 16 |
| | | | | |
| 14. | <p>a</p> <p>The crank and connecting rod of a vertical single cylinder gas engine running at 1800 rpm are 60mm and 240mm respectively. The diameter of the piston is 80mm and the mass of the reciprocating parts is 1.2 kg. At a point during the power stroke when the piston has moved 20mm from the top dead center, the pressure on the piston is 800 kN/m², Determine the</p> <ul style="list-style-type: none">(i) Net force on the piston(ii) Thrust in the connecting rod(iii) Thrust on the sides of the cylinder walls(iv) The engine speed at which the above values are zero | L3 | 4 | 16 |
| | | | | |
| Or | | | | |
| b | <p>Turning moment diagram for a multi cylinder engine has been drawn to a vertical scale of 1mm = 650 Nm and a horizontal scale of 1 mm = 4.5°. The areas above and below the mean torque line are -28, +380, -260, +310, -300, +242, -380, +265 and -229 mm². The fluctuation of speed is limited to ±1.8% of the mean speed which is 400 rpm. The density of the rim material is 7000 kg/m³ and the width of the rim is 4.5 times the thickness. The centrifugal stress in the rim material is limited to 6 N/mm². Neglecting the effect of the boss, and the arms, determine the diameter and the cross section of the flywheel rim.</p> | L3 | 4 | 16 |
| | | | | |
| 15. | <p>a</p> <p>A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100mm and that between B and C is 200mm. If the shaft is in complete dynamic balance, Determine:</p> <ul style="list-style-type: none">(i) The magnitude of the masses at A and D(ii) The distance between planes A and D(iii) The angular position of the mass at D | L3 | 5 | 16 |

Or

b A ship is propelled by a turbine rotor of mass 500 kg and has a speed of 2400 rpm. The rotor has a radius of gyration of 0.5 m and rotates in clockwise direction when viewed from stern. Find the gyroscopic effects in the following cases: L3 5 16

(i) The ship runs at a speed of 15 knots (1 knot = 1860 m/hr). It steers to the left in a curve of 60m radius

(ii) The ship pitches $\pm 5^\circ$ from the horizontal position with the time period of 20 s of simple harmonic motion

(iii) The ship rolls with angular velocity of 0.04 rad/s clockwise during pitching.

Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.